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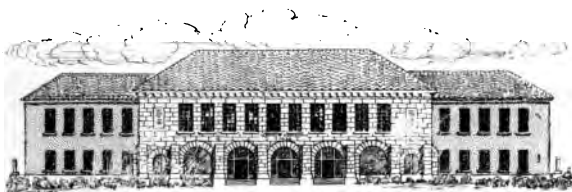


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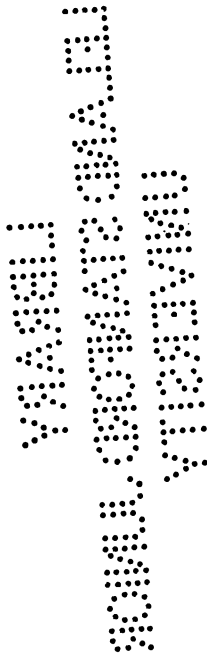
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W. P. I

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NOTE

IN this book a review of the fifth year's work is supplemented by more difficult problems and operations in the subjects included in the preceding book. The work in denominate numbers and practical measurements is extended; chapters on areas and volumes are included; interest, promissory notes, commission, trade discount, taxes, and insurance are introduced as applications of the principles of percentage; and a simple and logical treatment of ratio is presented.

The chapters devoted to review, general analysis, and miscellaneous work give a great variety of drill on the principles developed.

The method of treatment is largely inductive. The pupil is led to see the reason for the various processes, and is encouraged to formulate his own methods of operation.

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REVIEW WORK

LESSON 1

Add:

1.	2.	3.	4.	5.	6.
32	34	88	85	69	66
49	79	43	95	58	44
64	34	34	86	96	78
37	27	72	68	87	55
29	76	56	53	78	32
<u>36</u>	<u>38</u>	<u>47</u>	<u>74</u>	<u>69</u>	<u>76</u>

7.	8.	9.	10.	11.	12.
$5\frac{1}{2}$	$16\frac{3}{8}$	$21\frac{1}{8}$	$21\frac{1}{8}$	$29\frac{3}{8}$	$23\frac{8}{8}$
$16\frac{1}{4}$	$24\frac{1}{2}$	$16\frac{1}{8}$	$35\frac{1}{8}$	$47\frac{1}{8}$	$56\frac{1}{8}$
<u>$31\frac{3}{4}$</u>	<u>$39\frac{1}{4}$</u>	<u>$37\frac{1}{4}$</u>	<u>$29\frac{5}{8}$</u>	<u>$37\frac{5}{8}$</u>	<u>$28\frac{1}{2}$</u>

13.	14.	15.	16.	17.
21.06	60.395	34.29	\$38.92	\$187.72 $\frac{3}{4}$
42.71	76.001	72.05 $\frac{1}{2}$	76.74	321.65 $\frac{1}{8}$
29.06 $\frac{1}{4}$	39.42 $\frac{1}{2}$	28.014	89.37 $\frac{1}{2}$	74.53 $\frac{5}{8}$
32.025	74.005	64.21 $\frac{3}{4}$	104.72	92.37 $\frac{1}{2}$
76.40 $\frac{1}{2}$	66.06 $\frac{3}{8}$	98.37 $\frac{1}{10}$	87.87 $\frac{1}{2}$	304.78
<u>20.33$\frac{1}{8}$</u>	<u>74.66$\frac{3}{8}$</u>	<u>84.62$\frac{1}{2}$</u>	<u>54.62$\frac{1}{2}$</u>	<u>39.625</u>

18. $\frac{1}{2} + \frac{3}{4} = ?$	23. $\frac{3}{4} + \frac{1}{6} = ?$	28. $\frac{1}{6} + \frac{1}{2} = ?$	33. $\frac{3}{6} + \frac{1}{4} = ?$
19. $\frac{1}{3} + \frac{1}{2} = ?$	24. $\frac{1}{4} + \frac{5}{6} = ?$	29. $\frac{2}{5} + \frac{1}{4} = ?$	34. $\frac{3}{10} + \frac{1}{6} = ?$
20. $\frac{2}{3} + \frac{1}{4} = ?$	25. $\frac{2}{3} + \frac{3}{4} = ?$	30. $\frac{1}{2} + \frac{1}{10} = ?$	35. $\frac{3}{7} + \frac{1}{14} = ?$
21. $\frac{1}{3} + \frac{1}{6} = ?$	26. $\frac{1}{3} + \frac{1}{8} = ?$	31. $\frac{1}{3} + \frac{1}{6} = ?$	36. $\frac{5}{7} + \frac{2}{14} = ?$
22. $\frac{2}{3} + \frac{1}{2} = ?$	27. $\frac{2}{3} + \frac{3}{8} = ?$	32. $\frac{2}{3} + \frac{2}{5} = ?$	37. $\frac{1}{4} + \frac{5}{8} = ?$

38. William earned $\$ \frac{1}{2}$ on Monday and $\$ \frac{1}{5}$ on Tuesday. How much did he earn in both days?

39. Sarah having $\frac{3}{4}$ of a yard of ribbon bought $\frac{1}{4}$ of a yard. How much had she then?

40. A man bought $\frac{1}{2}$ of a dozen bananas at one store and $\frac{1}{5}$ of a dozen at another. How many bananas had he then?

41. $\frac{2}{3}$ of a certain number, increased by $\frac{3}{8}$ of the same number, equals 50. What is the number?

42. My age increased by its $\frac{1}{3}$ equals 60 yr. How old am I?

LESSON 2

1. A farmer cut $24\frac{3}{4}$ tons of hay from one field and $16\frac{3}{4}$ tons from another. How many tons did he cut from both?

2. A farmer gave to each of his three sons a farm. The oldest received $124\frac{3}{10}$ acres, the second $128\frac{5}{8}$ acres, and the third $119\frac{11}{10}$ acres. How many acres did the three farms together contain?

3. Find the L. C. M. of 10, 18, 20, 24.

4. Write in words: .9; .26; 4.0605; 31.01067.

5. Change to common fractions in lowest terms: .28; .80; .025; .004; .012; $.12\frac{1}{2}$; $.37\frac{1}{2}$; $.06\frac{1}{4}$.

6. Find the sum of 7.5, $8\frac{2}{3}$, 9.75, $6\frac{5}{8}$, 9.875.

7. $\frac{1}{4}$ of a cord + $\frac{1}{8}$ of a cord + 4 cord feet = how many cubic feet?

8. $\frac{8}{9}$ cu. yd. + $\frac{2}{3}$ cu. yd. + $10\frac{1}{2}$ cu. ft. = how many cubic feet?

9. What are the prime factors of 1072 and 2538?

10. What is the sum of $.33\frac{1}{3}$, $.66\frac{2}{3}$, $.16\frac{2}{3}$, $.12\frac{1}{2}$, and 12.5.

11. $1 - \frac{2}{5} =$ 16. $3\frac{1}{2} - \frac{1}{4} =$ 21. $.4 - \frac{1}{5} =$ 26. $\frac{5}{8} - \frac{1}{9} =$
 12. $2 - \frac{3}{8} =$ 17. $5\frac{3}{8} - \frac{1}{6} =$ 22. $.6 - \frac{2}{5} =$ 27. $\frac{7}{10} - \frac{1}{8} =$
 13. $\frac{7}{8} - \frac{3}{4} =$ 18. $3\frac{1}{2} - 2\frac{1}{4} =$ 23. $.9 - \frac{1}{2} =$ 28. $\frac{9}{30} - \frac{1}{15} =$
 14. $\frac{3}{4} - \frac{1}{3} =$ 19. $7\frac{2}{3} - 6\frac{1}{3} =$ 24. $1.4 - .2 =$ 29. $\frac{4}{5} - .3 =$
 15. $2 - \frac{3}{4} =$ 20. $4\frac{3}{5} - \frac{1}{10} =$ 25. $2.1 - .9 =$ 30. $\frac{3}{5} - .5 =$

31. Of a pole $\frac{1}{5}$ is in the mud, $\frac{1}{4}$ in the water, and the remainder is in the air. What part of the pole is in the air?

32. $2\frac{1}{2}$ tons $- 1\frac{1}{5}$ tons = how many pounds?

33. $\frac{7}{8}$ of a mile $- \frac{3}{8}$ of a mile = how many rods?

34. .25 of a gross $- 12\frac{1}{2}\%$ of a gross = how many dozen?

35. \$100 less 40% of \$200 = what a man paid for a suit of clothes. How much did he pay for the suit?

LESSON 3

1. $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} - \frac{5}{6} =$ 9. $12\frac{3}{4} - 8\frac{7}{16} + 6\frac{1}{8} =$
 2. $1 + 4\frac{1}{2} - 2\frac{1}{3} + \frac{1}{4} =$ 10. $18\frac{5}{8} - 8\frac{5}{12} + 10\frac{1}{3} =$
 3. $1\frac{1}{2} + \frac{4}{5} - \frac{2}{3} - \frac{1}{30} =$ 11. $12\frac{3}{4} - 7.14 =$
 4. $3\frac{1}{6} + \frac{2}{3} + \frac{3}{4} - 2\frac{3}{8} =$ 12. $22\frac{3}{8} - 8.12\frac{1}{2} =$
 5. $4\frac{5}{7} - 2\frac{1}{2} + 3\frac{1}{7} - \frac{1}{14} =$ 13. $39\frac{4}{5} - 18.365 =$
 6. $10\frac{5}{8} - 5\frac{1}{2} + 7\frac{1}{3} =$ 14. $66\frac{3}{8} - 21.66\frac{3}{8} =$
 7. $13\frac{8}{9} + 6\frac{2}{3} - 7\frac{2}{3} =$ 15. $129 - 114.38\frac{1}{3} =$
 8. $10\frac{5}{8} + 4\frac{1}{2} - 8\frac{7}{16} =$
 16. $16 \times 8\frac{3}{4} =$ 19. $63 \times 9\frac{5}{9} =$
 MODEL. $16 \times 8 = 128$ 20. $72 \times 11\frac{5}{8} =$
 $16 \times \frac{3}{4} = 12$ 21. $112\frac{3}{8} \times 32 =$
 $16 \times 8\frac{3}{4} = 140$ Ans. 22. $98\frac{3}{4} \times 16 =$
 17. $21 \times 9\frac{4}{7} =$ 23. $225\frac{4}{5} \times 25 =$
 18. $35 \times 7\frac{4}{5} =$ 24. $427\frac{7}{12} \times 24 =$

25. $4\frac{3}{9} \times 6\frac{1}{2} =$

MODEL. $4\frac{3}{9} = \frac{4^1}{\cancel{9}^3}$
 $6\frac{1}{2} = \frac{1^2}{\cancel{2}^1}$

$$\frac{22}{9} \times \frac{13}{2} = \frac{286}{9} = 31\frac{7}{9} \text{ Ans.}$$

26. $8\frac{4}{9} \times 7\frac{1}{2} =$

27. $5\frac{2}{3} \times 8\frac{3}{4} =$

28. $12\frac{1}{2} \times 6\frac{1}{4} =$

29. $7\frac{3}{10} \times 6\frac{5}{9} =$

30. $10\frac{5}{9} \times 18\frac{4}{9} =$

31. $7\frac{1}{2} \times 4.25 =$

32. $8\frac{3}{4} \times 9.33\frac{1}{3} =$

33. $2\frac{7}{8} \times 6.4 =$

34. $16.08\frac{1}{3} \times 5\frac{1}{2} =$

35. $9.16\frac{2}{3} \times 5\frac{3}{8} =$

36. Find the cost of $\frac{3}{8}$ of a yard of cloth at \$6 a yard.37. At \$1.20 a day how much will a man earn in $\frac{3}{4}$ of a day? In $1\frac{3}{8}$ days? In $2\frac{3}{8}$ days?38. Wheat weighs 60 lb. to the bushel. What is the weight of $2\frac{1}{2}$ bu.? $1\frac{1}{8}$ bu.? $2\frac{3}{4}$ bu.?39. If you gather $7\frac{3}{4}$ quarts of berries in 1 hr., how many quarts will you gather in 8 hr.?

40. How many yards are there in 2 rd.? 4 rd.? 5 rd.?

41. At $3\frac{1}{2}$ ¢ a pint, how much will $1\frac{1}{2}$ gal. of milk cost?42. Change to inches: $4\frac{1}{4}$ ft.; $2\frac{2}{3}$ yd.; $3\frac{1}{12}$ yd.; $2\frac{3}{4}$ yd.43. At $\$ \frac{4}{5}$ a peck, how much will $3\frac{3}{4}$ pk. of apples cost?44. How much will $5\frac{3}{8}$ lb. of beef cost at 16¢ a pound?45. A carpenter earns $\$2\frac{1}{4}$ a day. At the same rate, how much can he earn in a week?

LESSON 4

Find:

1. The area of a piece of oilcloth $8\frac{1}{2}$ ft. by $4\frac{3}{8}$ ft.
2. The cost of $24\frac{1}{2}$ lb. of starch at $11\frac{3}{4}$ ¢ a pound.
3. The area of a rectangular field $12\frac{3}{8}$ rd. by $25\frac{5}{8}$ rd.
4. The value of 2520 lb. of hay at $\$18\frac{7}{8}$ a ton.

5. The interest of \$144 for 2 yr. 8 mo. 24 da. at 6%.
6. The value of $5\frac{1}{2}$ bbl. of flour if $\frac{3}{4}$ of a barrel is worth \$4.80.
7. The cost of a pair of horses when \$156 $\frac{7}{8}$ is paid for 1 horse.
8. The number of cubic feet in a piece of timber 8 ft. long, 8 in. thick, and 9 in. wide.
9. The area of a rectangle whose base is 20 rd. and altitude 16 rd.
10. The gain on 25 $\frac{1}{2}$ lb. of tea when bought at 50¢ a pound, and sold at $\$ \frac{7}{8}$ a pound.
11. If 7 boys earn \$5 $\frac{1}{4}$ in a day, how much will 5 boys earn in the same time? In one half of the time?
12. At $\frac{3}{4}$ of a cent each, how many pencils can be bought for \$1 $\frac{1}{8}$?
13. How many bushels of corn can be bought for \$8 $\frac{5}{8}$ if 1 bu. costs \$.80?
14. If 4 $\frac{4}{5}$ yd. of lace cost 48¢, how much will 9 $\frac{3}{5}$ yd. cost at the same rate?
15. What part of 50 is 12 $\frac{1}{2}$? 8 $\frac{1}{3}$? What per cent of 50 is 12 $\frac{1}{2}$? 8 $\frac{1}{3}$? 10? 5?
16. What per cent of 100 is 12 $\frac{1}{2}$? 37 $\frac{1}{2}$? 62 $\frac{1}{2}$? 87 $\frac{1}{2}$? 112 $\frac{1}{2}$?
17. If 1 $\frac{3}{7}$ tons of coal cost \$6.50, how much will 1 ton cost?
18. Divide 48 by 2 $\frac{3}{4}$.
21. $32 \div 10\frac{5}{8} = ?$
- MODEL. $2\frac{3}{4} = \frac{11}{4}$.
22. $36 \div 12\frac{4}{9} = ?$
- $48 \div \frac{8}{3} = 48 \times \frac{3}{8} = 18$ Ans.
23. $42 \div 13\frac{5}{7} = ?$
24. $48 \div 15\frac{3}{8} = ?$
19. $25 \div 8\frac{3}{4} = ?$
25. $63 \div 21\frac{7}{8} = ?$
20. $28 \div 9\frac{3}{7} = ?$
26. $75 \div 28\frac{3}{4} = ?$

27. At $\$13\frac{3}{4}$ a week, how long will it take a man to earn $\$440$?

28. How many pairs of gloves at $\$1.37\frac{1}{2}$ a pair can be bought for $\$55$?

LESSON 5

1. At $\$2\frac{3}{4}$ a gallon, how many gallons of maple sirup can be bought for $\$1\frac{1}{2}$? $\$3\frac{3}{4}$? $\$6\frac{3}{4}$? $\$8\frac{1}{4}$?

2. At $\$3\frac{3}{8}$ a peck, how many bushels of apples can be bought for $\$3\frac{3}{8}$?

3. $\frac{3}{4} \div \frac{4}{5} = ?$ $\frac{4}{5} \div \frac{3}{4} = ?$ $\frac{7}{9} \div \frac{5}{12} = ?$ $\frac{5}{12} \div \frac{7}{9} = ?$
 $\frac{2}{3} \div \frac{3}{5} = ?$

4. At $\$2\frac{2}{5}$ a bushel, how many bushels of tomatoes can be bought for $\$3\frac{1}{5}$?

5. At the rate of $\frac{3}{8}$ bu. a day, how long will $4\frac{1}{8}$ bu. of oats last a horse?

6. How many acres are there in 8 building lots, each containing $\frac{5}{7}$ acres?

7. $\frac{5}{7}$ of 21 is $\frac{5}{9}$ of what number?

8. Divide $8\frac{3}{4}$ by $8\frac{1}{3}$.

11. $12\frac{2}{3} \div 8\frac{2}{5} = ?$

MODEL. $8\frac{3}{4} = \frac{35}{4}$; $8\frac{1}{3} = \frac{25}{3}$.

12. $18\frac{1}{2} \div 1\frac{2}{3} = ?$

$$\frac{35}{4} \div \frac{25}{3} = \frac{35}{4} \times \frac{3}{25} = \frac{21}{20} = 1\frac{1}{20} \text{ Ans.}$$

13. $16\frac{1}{4} \div 8\frac{1}{3} = ?$

14. $\frac{5}{23}$ of $15\frac{1}{3} = ?$

9. $9\frac{3}{4} \div 2\frac{1}{3} = ?$

15. $\frac{9}{25}$ of $16\frac{2}{3} = ?$

10. $16\frac{5}{8} \div 8\frac{5}{16} = ?$

16. $\frac{5}{19}$ of $12\frac{2}{3} = ?$

17. $20.12 \div 5 = ?$ $800.008 \div 16 = ?$ $300.006 \div 90 = ?$
 $80 \div .16 = ?$

18. If .9 of the value of a farm is \$2700, what is the value of the farm?

19. How many cords of wood at \$5.25 a cord will pay for 112 bu. of wheat at 75¢ a bushel?

20. An automobile goes $185\frac{1}{2}$ miles in 4 hours. How far will it go in $\frac{5}{8}$ of an hour?

21. If $\frac{2}{3}$ of a yard of cloth is worth \$ $\frac{5}{8}$, find the cost of $16\frac{2}{3}$ yards.

22. If \$ $7\frac{1}{8}$ will pay for $1\frac{2}{3}$ tons of coal, how much coal will \$ $21\frac{3}{8}$ pay for?

23. Find the prime factors common to 162 and 192.

24. How much will 2 bu. 2 pk. 4 qt. of beans cost at $3\frac{2}{3}$ ¢ a pound, allowing 60 lb. to equal a bushel?

LESSON 6

1. Multiply 40 sq. rd. 16 sq. yd. 7 sq. ft. by 6.

2. How many cubic inches are in a board 16 ft. long, 12 in. wide, and 1 in. thick? How many board feet?

3. Express \$560 in English money.

4. Change $\frac{5}{8}$, $\frac{21}{4}$, $\frac{5}{11}$, $\frac{21}{3}$ to 88ths.

5. How many board feet are there in 120 boards, each 16 ft. long, 9 in. wide, and 1 in. thick?

6. Find the exact number of days from Jan. 17, 1900, to Sept. 17 of the same year.

7. Change .475 to a common fraction in lowest terms.

8. How many rods equal .475 of a mile?

9. Make a bill for 5 articles bought at a hardware store to-day, and receipt it as clerk.

10. How many times must a man walk around a rectangular piece of land $49\frac{2}{3}$ rd. long and $30\frac{1}{2}$ rd. wide in order to travel $80\frac{1}{2}$ miles?

11. If a man travel 29.6 miles a day, in how many days will he travel 33,152 rods?

12. Change $\frac{1}{80}$ to a decimal.

13. At 6%, what is the interest of \$1 for 1 yr.? For 6 mo.? For 1 mo.?

14. What is the interest of \$2 for 1 mo. at 6%?

15. A's land is $\frac{7}{8}$ of $\frac{4}{21}$ of B's. If A owns $60\frac{5}{8}$ acres, how many acres does B own?

16. How many yards of material at $\$3\frac{3}{8}$ a yard can be bought for $\$5\frac{1}{4}$? For $\$4\frac{2}{7}$ at $\$1\frac{5}{14}$ a yard?

17. John raised 60 bu. of wheat, which was $\frac{1}{6}$ less than his brother raised. How many bushels did his brother raise?

18. What per cent of a quantity is $\frac{36}{100}$ of it?

19. Find the cost of 36% of 200 bu. of oats at $\$1\frac{1}{2}$ a bu.

20. How much will 2 gross of pens cost at $\frac{1}{2}$ of a cent apiece?

21. What is a cube? A cubic inch? A cubic foot?

22. How do you find the volume of a rectangular solid?

LESSON 7

1. Find the value of 2 oz. 5 dr. of quinine at $\frac{1}{3}$ of a cent a grain.

2. How many cubic inches equal $1\frac{1}{2}$ of a cubic foot?

3. Find the cost of plastering the walls and ceiling of a room 48 ft. long, 36 ft. wide, and 12 ft. high, at 20¢ a square yard, no allowance being made for openings.

4. I have a room 19 ft. long and 16 ft. wide, the floor of which I wish to cover with carpet 1 yard wide. How many yards will be needed if there is a loss of $1\frac{1}{2}$ yd. in matching, the carpet running the longer dimension of the room? How many breadths are needed for the room? How much must be turned under at one side? Find the cost of the carpet at 85¢ a yard. Draw a plan of the room, using $\frac{1}{4}$ in. for a foot, and mark the breadths.

5. Add $.85\frac{1}{4}$, $16\frac{2}{3}$, $47\frac{1}{2}$, $.75\frac{1}{3}$, 225.36, and $7\frac{5}{8}$. Express the answer in words.

6. At $\$3\frac{1}{2}$ a yard, how much will $8\frac{3}{4}$ yards cost?

7. What is the value of 84% of 6175 bu. of corn at 52¢ a bushel?

8. Divide 8.505 by $\frac{1}{8}$, and express the quotient in three different forms.

9. What is $\frac{1}{5}$ of $\frac{3}{4}$? $\frac{1}{4}$ of $\frac{2}{3}$? $\frac{2}{5}$ of $\frac{5}{8}$? $\frac{3}{8}$ of $\frac{5}{7}$? $\frac{2}{3}$ of $\frac{6}{7}$?

10. How many boxes, holding $\frac{7}{8}$ of a quart each, will be required to hold $14\frac{7}{8}$ bu. of huckleberries?

11. Divide $\frac{3}{4}$ by $\frac{1}{5}$. $\frac{2}{3}$ by $\frac{1}{6}$. $\frac{5}{8}$ by $\frac{2}{5}$. $\frac{6}{7}$ by $\frac{2}{3}$. $\frac{5}{7}$ by $\frac{3}{8}$.

12. At $\$1\frac{1}{5}$ a yard, how many yards of ribbon can you buy for $\$3\frac{3}{4}$?

13. $\frac{1}{8}$ mi. + $\frac{1}{4}$ mi. = how many rods?

14. If the interest of a note for 8 months is \$32, how much is the interest for $\frac{3}{4}$ of a year?

15. What per cent of a day is 12 hr.? 6 hr.? 8 hr.?

LESSON 8

1. A man had 72 turkeys and sold $62\frac{1}{2}\%$ of them on Thanksgiving. How many had he left?

2. A farmer raised 160 chickens and sold $87\frac{1}{2}\%$ of them. How many did he sell?

3. How many cubic feet are there in 20 planks 16 ft. long, 1 ft. wide, and 2 in. thick?

4. Divide 1.5639 by 130. Divide 6 by .005.

5. A man spent .3 of his money for books, and $\frac{1}{5}$ of it for clothes, and had \$38.46 left. How much did he spend for books?

6. Express in figures: MDCCXXIX; \overline{D} ; \overline{M} ; \overline{MD} .

7. My milkman left me 1 qt. of milk each week day and 2 qt. of milk and 1 pt. of cream each Sunday during the year 1900. How much was my milk bill for the year if I paid 6¢ a quart for the milk and 20¢ a quart for the cream, the first day of the year being Monday?

8. Find the cost of 16.25 cords of wood at \$5.37 $\frac{1}{2}$ a cord.

9. Change 160 $\frac{5}{8}$ to 45ths. Divide 42 $\frac{7}{16}$ by 4.5.

10. Find the cost of 16,480 ft. of lumber at \$36.75 per M.

11. I have a square field each side of which is 60 $\frac{1}{2}$ rd. How much will it cost to inclose it with a fence at 7 $\frac{1}{5}$ ¢ a foot?

12. Find the area of a rectangular field whose length is twice its width, if one end measures 40 rd.

13. What is the price per quart when 45 $\frac{1}{2}$ ¢ is paid for 6 qt. 1 pt. of milk?

14. Find the area of a circle whose radius is 14 inches.

15. Find the value of $\frac{3}{8}$ of a sack of coffee worth \$25.37 $\frac{1}{2}$.

16. A grocer bought 100 bu. 2 pk. of potatoes at \$ $\frac{3}{5}$ a bushel. He sold .25 of them for \$ $\frac{1}{2}$ a bushel and the remainder for \$ $\frac{2}{5}$ a bushel. What was his gain?

DENOMINATE NUMBERS

LESSON 9

Money is the measure of value of articles bought, sold, or exchanged.

It consists of two kinds, *specie* or *coin*, and *paper money*.

Specie or **Coin** consists of metal, such as gold, silver, nickel, and bronze, stamped, and authorized under the government to be used as money.

Paper Money, issued for convenience in business under authority of government, consists of printed promises to pay the bearer a stated amount on demand. National bank notes, United States notes, treasury notes, gold certificates, and silver certificates are the kinds of paper money now in circulation, in the **United States**.

The gold and silver coins consist of $\frac{9}{10}$ pure metal and $\frac{1}{10}$ copper. The mill is not coined. The gold dollar (not coined now) weighs 25.8 grains Troy. The silver dollar weighs 412.5 grains Troy.

1. Name the coins in use now.
2. In writing United States money, where should the decimal point be placed?
3. How many mills in $2\frac{1}{2}\text{¢}$? In $\$ \frac{1}{4}$? In 1 dime? In $\$ \frac{1}{8}$? In $2\frac{3}{4}\text{¢}$? In .4 of a dime?

4. How many cents in 450 mills? In 5 mills? In 16.8 mills? In 250.3 mills? In $\frac{1}{5}$ of a mill?

Memorize :

- | | | |
|--|---|--|
| 5. $6\frac{1}{4}\text{¢} = \$\frac{1}{16}$. | 9. $33\frac{1}{3}\text{¢} = \$\frac{1}{3}$. | 13. $83\frac{1}{3}\text{¢} = \$\frac{5}{8}$. |
| 6. $8\frac{1}{3}\text{¢} = \$\frac{1}{12}$. | 10. $37\frac{1}{2}\text{¢} = \$\frac{3}{8}$. | 14. $87\frac{1}{2}\text{¢} = \$\frac{7}{8}$. |
| 7. $12\frac{1}{2}\text{¢} = \$\frac{1}{8}$. | 11. $62\frac{1}{2}\text{¢} = \$\frac{5}{8}$. | 15. $41\frac{2}{3}\text{¢} = \$\frac{5}{12}$. |
| 8. $16\frac{2}{3}\text{¢} = \$\frac{1}{6}$. | 12. $66\frac{2}{3}\text{¢} = \$\frac{2}{3}$. | 16. $75\text{¢} = \$\frac{3}{4}$. |

LESSON 10

1. Find the cost of 24 yd. of silk ribbon at $6\frac{1}{4}\text{¢}$ a yard. At $8\frac{1}{2}\text{¢}$. At $62\frac{1}{2}\text{¢}$. At $87\frac{1}{2}\text{¢}$.

2. At $66\frac{2}{3}\text{¢}$ a yard, how many yards of silk ribbon can you buy for \$2? For \$8? For \$9 $\frac{1}{2}$?

3. Change to dimes: 25¢; $3\frac{1}{8}\text{¢}$; $2\frac{1}{2}\text{¢}$; $62\frac{1}{2}\text{¢}$; 60m.; \$.025.

4. Change to dollars: 325¢; 16d.; $4\frac{3}{4}\text{d.}$; 8.5d.; 2.5d.; $2\frac{1}{2}\text{m.}$

5. At the rate of 3 pears for a nickel, how many pears can be bought for \$.165?

6. Make three problems in which the cost of each article sold is $62\frac{1}{2}\text{¢}$.

7. Make three problems in which the cost of each article bought is $66\frac{2}{3}\text{¢}$.

English Money, sometimes called sterling money, is the legal currency of Great Britain.

The unit is the *pound sterling* (£).

There is no coin known as the pound sterling. It is represented by a gold coin called a *sovereign*.

The coins used in England are as follows :

Gold coins : *sovereign* (20s.); *half sovereign* (10s.).

Silver coins : *crown* (5s.); *half crown* (2s. 6d.); *florin* (2s.); *double florin* (4s.); *shilling*; *sixpence*; *threepence*.

Copper coins : *penny*; *half penny*; *farthing*.

The approximate value in United States money of £1 is \$4.8665; 1 shilling, \$.243; 1 penny, \$.02.

8. How many farthings in 8 pence? 8 pence = what part of a shilling?

9. How many pence in 5 shillings? In 6s. 4d.?

10. How many shillings in 36d.? 42d.? 108d.? 180d.?

11. How many cents in 2 shillings? In 3s. 6d.?

12. 75¢ equal how many shillings? 48 cents equal how many pence?

13. 8 cents are what part of 8 pence?

LESSON 11

1. Change £6 8s. 9d. to farthings.

2. Change 570 far. to higher denominations.

3. Add, and then change to pence, £4 8s. 6d., £8 5s. 9d., £2 6s. 4d.

4. Subtract £4 7s. 8d. from £7 3s. 4d.

5. Multiply £7 5s. 3d. 3 far. by 6.

6. Divide £16 12s. 6d. by 5.

7. \$36.50 = about how many pounds?

8. What is the approximate value in United States money of £4? £3 10s.? 8s.?

9. About how many pounds and shillings can I get for \$20? \$75?

10. Change £ $\frac{3}{8}$ to lower denominations.

$$\text{MODEL. } £\frac{3}{8} = \frac{3}{8} \times 20s. = \frac{15}{4}s. = 7\frac{1}{4}s.$$

$$\frac{1}{4}s. = \frac{1}{4} \times 12d. = 6d.$$

$$£\frac{3}{8} = 7s. 6d. \text{ Ans.}$$

11. Change £ $\frac{2}{3}$ to lower denominations.

12. Change $\frac{3}{4}$ far. to the fraction of a shilling.

$$\text{MODEL. } 1s. = 48 \text{ far.}$$

$$1 \text{ far.} = \frac{1}{48}s.$$

$$\frac{3}{4} \text{ far.} = \frac{3}{4} \times \frac{1}{48}s. = \frac{1}{64}s. \text{ Ans.}$$

13. Change $\frac{5}{8}$ far. to the fraction of a shilling.

The following table shows the estimated value, in United States money, of the monetary unit of the most important nations of the world:

COUNTRY	DENOMINATION	VALUE
Austria-Hungary	Crown	\$.203
Belgium	Franc . . . . .	.193
Brazil	Milreis. . . . .	.546
Canada	Dollar	1.00
Chile	Peso . . . . .	.912
Denmark	Crown . . . . .	.268
France	Franc . . . . .	.193
German Empire	Mark . . . . .	.238
Great Britain	Pound Sterling.	4.8665
Italy	Lira . . . . .	.193
Japan	Yen . . . . .	.997
Mexico	Dollar { Gold . . . . .	.983
	{ Silver . . . . .	.528
Russia	Ruble . . . . .	.772
Spain	Peseta . . . . .	.193
Sweden	Crown . . . . .	.268
Switzerland	Franc . . . . .	.193

LESSON 12

1. What part of a pound is 8s. 4d.? 120d.?
2. What part of a pound is 480 far.?
3. If I pay £1 a week for board, how much is the price per day? How much per meal?
4. A man bought a quantity of silk for £17 9s. Express the cost in United States money.
5. An importer purchased silk at 10 francs a yard and retailed it at \$2.12½ a yard. Find the gain.
6. Change to United States money : 250 francs ; 500 marks ; 300 rubles ; 350 lira.
7. \$500 equal how many rubles? How many francs? How many marks? How many lira?

Long Measure is used in measuring lines or estimating distances. The standard unit of long measure is the yard.

$$1 \text{ mi.} = 320 \text{ rd.} = 1760 \text{ yd.} = 5280 \text{ ft.} = 63,360 \text{ in.}$$

8. Change 2 mi. 180 rd. 4 yd. 2 ft. 8 in. to inches.
9. Change 683,721 in. to higher denominations.
10. How many inches in $6\frac{1}{2}$ yd.? $\frac{2}{3}$ ft.? $.16\frac{2}{3}$ of 2 yd.? .16 ft.? $.5\frac{1}{3}$ yd.? $.08\frac{1}{3}$ of 3 ft.?
11. Find the sum of 21 mi. 42 rd. 3 yd. 2 ft. 9 in., 32 mi. 14 rd. 13 ft. 8 in., 32 rd. 16 ft. 7 in., 18 mi. 9 ft. 9 in.
12. Multiply 18 rd. 5 yd. 11 in. by 9.
13. Divide 160 mi. 49 rd. 9 ft. 4 in. by 7.
14. Express $\frac{3}{4}$ of a rod in integers of lower denominations.

$$\begin{aligned} \text{MODEL. } \frac{3}{4} \text{ rd.} &= \frac{3}{4} \times 16\frac{1}{2} \text{ ft.} = 12\frac{3}{4} \text{ ft.} \\ \frac{3}{4} \text{ ft.} &= \frac{3}{4} \times 12 \text{ in.} = 9 \text{ in.} \\ \frac{3}{4} \text{ rd.} &= 12 \text{ ft. } 4\frac{1}{2} \text{ in.} \quad \text{Ans.} \end{aligned}$$

LESSON 13

1. Express .75 rd. in integers of lower denominations.

MODEL. $.75 \text{ rd.} = .75 \times 16\frac{1}{2} \text{ ft.} = 12.375 \text{ ft.}$

$.375 \text{ ft.} = .375 \times 12 \text{ in.} = 4.5 \text{ in.}$

$.75 \text{ rd.} = 12 \text{ ft. } 4.5 \text{ in.} \quad \text{Ans.}$

Express in integers of lower denominations:

2. $\frac{1}{8}$ of a mile.
5. .75 of a mile.
3. $\frac{3}{8}$ of a mile.
6. .1875 of a mile.
4. $\frac{9}{10}$ of a mile.
7. $\frac{7}{8}$ of a rod.
8. Change to yards: .4 mi.; 3.2 rd.; $.3\frac{1}{2}$ ft.
9. Change to rods: .05 mi.; $66\frac{2}{3}\%$ of 5 mi.; $2\frac{1}{2}$ ft.; $6\frac{1}{4}$ yd.
10. Change 2 yd. 1 ft. 11 in. to the fraction of a rod.

MODEL. $1 \text{ rd.} = 192 \text{ in.}$

$2 \text{ yd. } 1 \text{ ft. } 11 \text{ in.} = 95 \text{ in.}$

$1 \text{ in.} = \frac{1}{192} \text{ of a rod.}$

$95 \text{ in.} = 95 \times \frac{1}{192}, \text{ or } \frac{95}{192} \text{ rd.} \quad \text{Ans.}$

11. Change 2 ft. 3 in. to the fraction of a rod.
12. Change 3 yd. 1 ft. 8 in. to the fraction of a rod.
13. Change $\frac{3}{4}$ mi. to integers of lower denominations.
14. Change 128 rd. 4 yd. 2 ft. 6 in. to the fraction of a mile.
15. Change 147 rd. 3 ft. 3.6 in. to the decimal of a mile.

MODEL. $147 \text{ rd. } 3 \text{ ft. } 3.6 \text{ in.} = 29145.6 \text{ in.}$

$1 \text{ mi.} = 63360 \text{ in.}$

$29145.6 \div 63360 = .46 \text{ mi.} \quad \text{Ans.}$

16. Change 46 rd. 6 ft. 7.2 in. to the decimal of a mile.
17. Change 2 yd. 1 ft. 1.5 in. to the decimal of a rod.

18. Change 139 rd. 1 yd. 3.6 in. to the decimal of a mile.
19. Change $\frac{8}{9}$ rd. to integers of lower denominations.
20. Change .875 rd. to integers of lower denominations.

LESSON 14

1. Reduce $\frac{1}{2\frac{3}{4}}$ of a rod to the fraction of an inch.

MODEL. $\frac{1}{2\frac{3}{4}}$ rd. = $\frac{1}{2\frac{3}{4}} \times 16\frac{1}{2}$ ft. = $\frac{1}{15\frac{1}{8}}$ ft.
 $\frac{1}{15\frac{1}{8}}$ ft. = $\frac{1}{15\frac{1}{8}} \times 12$ in. = $\frac{1}{1\frac{1}{4}}$ in. *Ans.*

2. Reduce $\frac{1}{2\frac{1}{6}\frac{1}{4}}$ of a rod to the fraction of an inch.
3. Reduce $\frac{4}{9\frac{1}{9}}$ of a rod to the fraction of a foot.
4. Reduce $\frac{1}{8\frac{6}{6}\frac{0}{0}\frac{0}{0}}$ of a mile to the fraction of a foot.
5. Reduce $\frac{3}{4}$ of a foot to the fraction of a mile.

MODEL. 1 mi. = 5280 ft.
 1 ft. = $\frac{1}{5280}$ mi.
 $\frac{3}{4}$ ft. = $\frac{3}{4} \times \frac{1}{5280}$ mi. = $\frac{3}{21120}$ mi. *Ans.*

6. Reduce $\frac{4}{5}$ yd. to the fraction of a mile.
7. Reduce $\frac{3}{4}$ ft. to the fraction of a rod.
8. Reduce $\frac{7}{8}$ in. to the fraction of a yard.
9. Find the sum of $\frac{5}{8}$ mi. $\frac{2}{3}$ rd. .375 yd.

	rd.	yd.	ft.	in.
MODEL. $\frac{5}{8}$ mi. =	177	4	0	10
$\frac{2}{3}$ rd. =		3	2	0
.375 yd. =			1	$1\frac{1}{2}$
	178	$2\frac{1}{2}$	0	$11\frac{1}{2}$
		$\frac{1}{2}$ =	1	6
	178	2	2	$5\frac{1}{2}$ <i>Ans.</i>

10. Find the sum of .45 mi., $\frac{5}{8}$ rd., $\frac{2}{3}$ yd., .32 ft.
11. Find the sum of $\frac{7}{8}$ mi., $\frac{2}{3}$ rd., $\frac{4}{5}$ ft.
12. Find the sum of .625 mi., .25 rd., .375 yd.

LESSON 15

1. From $\frac{3}{4}$ mi. take $\frac{2}{3}$ of 140 rd.

	rd.	ft.	in.
MODEL. $\frac{3}{4}$ mi. =	137	2	$4\frac{1}{2}$
$\frac{2}{3}$ of 140 rd. =	93	5	6
	43	$12\frac{1}{4}$	$10\frac{3}{4}$
		$\frac{1}{4}$ =	6
	43	13	$4\frac{1}{2}$ Ans.

2. From $9\frac{3}{4}$ mi. take 6 mi. 165 rd. 9 ft.
 3. Take $\frac{7}{8}$ rd. from $\frac{7}{8}$ mi.
 4. From $\frac{3}{4}$ of 42 mi. take $\frac{2}{3}$ of 16 mi. 1 rd. 9 ft.
 5. How much will $\frac{3}{4}$ of a mile of fence cost at \$1.50 a rod?
 6. If a boy can earn £5 12s. 6d. in 6 da., how much can he earn in 1 da.? Express answer in United States money.
 7. If a primer costs 9d., how many primers can be bought for £6 6s.?
 8. Each side of a square field is 100 rd. 3 yd. 2 ft. 6 in. What is the distance around it?
 9. If a ship sails 12 mi. 240 rd. $2\frac{3}{4}$ yd. in an hour, in how many hours will she sail 408 mi. 16 rd.?
 10. How many pence equal £ $\frac{4}{5}$ + $\frac{3}{8}$ s.?

LESSON 16

The principles of reduction as explained in Long Measure apply to all denominate numbers.

Surveyors' Linear Measure is used by surveyors and engineers in measuring distances, as roads, dimensions of land, etc.

Gunter's chain, named after its inventor, Edmund Gunter, is 792 inches, or 66 ft., or 4 rd. long, divided into 100 links of 7.92 in. each. Engineers generally use a chain or tape 100 ft. long.

1. How many chains in 5 mi.? $2\frac{1}{2}$ mi.? $5\frac{1}{2}$ mi.?
2. How many links in 5 ch.? 10 ch.? $6\frac{1}{2}$ ch.?
3. How many feet in 2 ch.? How many miles in 240 ch.?
4. What part of a mile is 20 ch.? 48 rds. equal how many chains?
5. How many chains in 132 ft.? 720 ch. equal how many miles?
6. How many chains in 550 li.? In 825 li.?
7. Reduce 2 mi. 36 ch. 24 li. to links.
8. Reduce 64 ch. 75 li. 2 in. to inches.
9. Change 6336 in. to chains.
10. Find the cost of constructing a road bed for a railroad 80 mi. 70 ch. at \$2000 a mile.
11. Change 42 ch. 60 li. to rods. To feet.
12. 45 ch. 80 li. equal what part of a mile?
13. A boy rode on his bicycle a distance of 30 ch. in 45 sec. At the same rate, how long would it take him to go a mile?
14. How many chains and links in 480 li.?
15. Reduce $\frac{3}{8}$ ch. to units of lower denominations.
16. Change $\frac{3}{8}$ ch. to the fraction of a mile.

LESSON 17

1. What is a surface?

Any plane surface bounded by three or more straight lines is called a **Polygon**. The **Area** of a polygon is the

amount of surface included within its bounding lines. The area is measured by some square unit.

The principal surface measure units are the *square inch*, *square foot*, *square yard*, *square rod*, *square link*, *square chain*, and *acre*.

2. Describe each of the above surface measure units.
3. How many square inches equal $\frac{5}{12}$ sq. ft.?
4. What is the difference between 3 sq. ft. and 3 ft. sq.?
5. 100 sq. in. equal what part of a square foot?
6. 120 sq. rd. equal what part of an acre?
7. 50% of an acre equal how many square rods?
8. What is the relation of 40 sq. rd. to $\frac{1}{2}$ A.?
9. What part of an acre is a piece of land 8 rd. long and 4 rd. wide?
10. How many rods are there in a chain?
11. A square chain equals what part of an acre?
12. Reduce 18 sq. yd. 4 sq. ft. 27 sq. in. to square inches.
13. Reduce 8 A. 150 sq. rd. 27 sq. yd. to square feet.
14. Reduce 129,600 sq. in. to square yards.
15. From 5 A. 84 sq. rd. 12 sq. yd. 4 sq. ft. 68 sq. in. take 3 A. 95 sq. rd. 28 sq. yd. 6 sq. ft. 95 sq. in.
16. Divide 66 sq. yd. 6 sq. ft. 24 sq. in. by 8.
17. Change to square inches: 4 sq. ft.; .04 sq. ft.; $4.3\frac{1}{2}$ sq. ft.
18. Change to square feet: 108 sq. in.; $11\frac{1}{3}\%$ of 10 sq. yd.
19. Reduce $\frac{2}{11}$ sq. mi. to integers of lower denominations.

LESSON 18

1. Change to square yards: 3.1 sq. rd. ; 432 sq. in. ; .9 sq. ft. ; 2.5 A. ; $39\frac{3}{8}$ sq. ft.
2. How many square rods are there in $37\frac{1}{2}\%$ of a piece of land containing 5 A.?
3. What part of an acre is 60 sq. rd.? 242 sq. yd.?
4. What part of an acre is a piece of land 33 ft. by 132 ft.?
5. Find the number of acres in a rectangular piece of land 132 yd. by $38\frac{1}{2}$ yd.
6. Find the cost of 2 A. of land if $\frac{3}{8}$ of a square rod costs 15¢.
7. What is the perimeter of a 5-rod square?
8. At \$87 $\frac{1}{2}$ an acre, find the cost of a square field 200 yd. long.
9. How many acres are there in 212,582 sq. ft.?
10. Change $\frac{7}{12}$ A. to lower denominations.
11. Change .225 A. to lower denominations.
12. A rectangular piece of land 32 ch. long and 16 ch. wide contains how many acres?
13. How many rods are there around a four-sided field whose sides measure 35 ch. 20 li., 16 ch. 18 li., 33 ch. 12 li., 18 ch. 9 li., respectively?
14. Change $\frac{5}{8}$ ch. to rods, feet, and inches.
15. For what is *square* or *surface* measure used?
16. Recite the table of square measure.
17. Recite the table of surveyors' linear measure. Surveyors' square measure.
18. How many acres are there in 25 sq. ch.?

19. Describe a township. A square mile is **what part** of a township?

20. What part of 9 chains square is 27 square chains?

21. How many breadths of carpet $\frac{3}{4}$ yd. wide are needed for 15 ft. of floor space?

22. I have a piece of land in the shape of a rectangle that contains $1\frac{1}{4}$ A. It is 10 rd. wide. How long is it?

LESSON 19

1. What is a solid? A rectangular solid? A cube?

2. Describe a cord of wood. A perch of stone or masonry.

The **Capacity** or volume of a solid is the space included within the bounding surfaces of the solid, and is measured by finding how many standard cubic units it contains.

The principal cubic measure units are the *cubic inch*, *cubic foot*, and *cubic yard*.

3. Describe each of the above cubic measure units. In what respect are they alike? Wherein do they differ?

Imagine a piece of board 5 in. long and 4 in. wide.

4. How many cubic inches does it contain if it is 1 in. thick?

5. How many cubic inches does it contain if it is 2 in. thick?

6. How many cubic inches does it contain if it is 3 in. thick?

7. How many cubic inches does it contain if it is $\frac{1}{2}$ in. thick?

8. How do you find the volume of a solid when the length, breadth, and depth, or thickness, are given?

9. Find the volume of the rectangular solid whose dimensions are 6 ft. by 5 ft. by 3 ft.
10. How many cubic inches are there in 18 cu. yd. 13 cu. ft.?
11. Reduce 846,979 cu. in. to cubic yards.
12. Divide 193 cu. yd. 26 cu. ft. 329 cu. in. by 11.
13. Change to cubic inches: .04 cu. ft.; $.66\frac{2}{3}$ of 1 cu. ft.; $33\frac{1}{3}\%$ of 100 cu. ft.
14. Change to cubic feet: 7776 cu. in.; 432 cu. in.; 2.5 cd.; $\frac{3}{4}$ of a perch; $\frac{1}{2}$ cu. yd.
15. Change to cubic yards: $\frac{3}{4}$ cd.; 2.5 perches; $20\frac{1}{4}$ cu. ft.
16. What is the difference between a 4-inch cube and 4 cubic inches?

LESSON 20

1. What is the unit of measure in *liquid measure*? In dry measure? State the capacity in cubic inches of each of the above units of measure.

A *gallon* of water weighs 8.33 lb.

The *quart*, liquid measure, equals $57\frac{3}{4}$ cu. in.

A *cubic foot* of water weighs $62\frac{1}{2}$ lb.

2. What is the weight of a 10-gallon can of water? Of 10 cu. ft. of water?

3. The capacity of $7\frac{1}{2}$ gal. equals 1 cu. ft. What is the capacity of 15 gal.? $22\frac{1}{2}$ gal.? 30 gal.? $52\frac{1}{2}$ gal.?

4. The quart, dry measure, contains 67.2 cu. in. How many cubic inches in a pint? In 2 quarts?

5. 4 bushels of grain occupy about 5 cu. ft. of space. How much space will 8 bu. occupy? 12 bu.? 16 bu.? 1 bu.?

6. How many bushels will 10 cu. ft. of space contain?
30 cu. ft.? 60 cu. ft.? 45 cu. ft.?
7. Change 120 cu. ft. to gallons. 120 gal. to cubic feet.
8. Change 120 cu. ft. to bushels. 120 bu. to cubic feet.
9. Change 20 cu. ft. of water to pounds.
10. Change a quart (dry) to cubic inches.
11. Change a quart (liquid) to cubic inches.
12. 20 quarts dry measure equal how many quarts liquid measure?
13. How many gills are there in $37\frac{1}{2}\%$ of a gallon? In .04 gal.? In 2 qt. 1 pt. 2 gi.? In $.12\frac{1}{2}$ of a quart?
14. Reduce to pints: $.3\frac{1}{3}$ qt.; $.3\frac{1}{3}$ pt.; 16 gi.; 1.6 gi.; $6\frac{1}{4}\%$ of 2 gal.
15. Change to quarts: 2.5 pt.; 4.5 gal.; $\frac{5}{8}$ gal.
16. Divide 37 bu. 1 pk. 2 qt. 1 pt. by 9.
17. How many pint bottles will be required to hold a barrel of cider?
18. Find the cost of $\frac{2}{3}$ of a gallon of cider at 6¢ a pint.

LESSON 21

1. A farmer feeds each of his 4 horses 10 qt. of oats daily. How long will 456 bu. 1 pk. last them?
2. A farmer raised $321\frac{3}{4}$ bu. of wheat. He kept 64 bu. 1 pk. 3 qt. for seed and 36.375 bu. for family use. He sold the remainder at 96¢ a bushel. How much did he receive for what he sold?
3. Find the cost of 3.75 pecks of beans at $87\frac{1}{2}$ ¢ a bushel.

4. Reduce to quarts: .8 bu.; $12\frac{1}{2}\%$ of 2 bu.; 14.2 pk.
5. Reduce to pecks: $62\frac{1}{2}\%$ of a bushel; $18\frac{2}{3}$ qt.
6. Change to bushels: 12.5 pt.; 1.28 qt.; $66\frac{2}{3}\%$ of a peck; .08 pk.
7. What part of a bushel is $\frac{1}{8}$ of a peck?

The **Weight** of a body is the measure of the attraction between it and the earth.

There are three English systems of weight. These are **Avoirdupois**, **Troy**, and **Apothecaries'**. The standard from which the units of these three systems are derived is the *Troy pound* of the mint. It is divided into 5760 equal parts called grains. The *Avoirdupois pound* equals 7000 grains, and the *Apothecaries' pound* 5760 grains.

8. For what is Troy weight used? Avoirdupois weight? Apothecaries' weight?

9. If 6 oz. of coffee are worth 12¢, how much are 2 lb. 8 oz. worth?

10. How much must be paid for 1200 lb. of hay at \$15 a ton?

11. How much will a turkey weighing 9 lb. 12 oz. cost at 12¢ a pound?

12. What part of a ton is 25 lb.? $2\frac{1}{2}$ cwt.?

LESSON 22

1. How many spoons, each weighing 2 oz., can be made from $3\frac{3}{4}$ lb. of silver?

2. How many 2-grain pills can be made from 2 lb. 23 25 of quinine?

3. Change $\frac{3}{4}$ of a ton to pounds and ounces.

4. Change .45 lb. to ounces.

5. If 1 silver spoon weighs 2 oz. 15 pwt. 10 gr., find the weight of $2\frac{1}{2}$ dozen.

6. Find the value of 100 gold watch cases, each weighing 4 oz., at 4¢ a grain.

7. The gold dollar weighs 25.8 grains. Find the weight of *ten* 20-dollar gold pieces.

8. The silver and gold coins are one tenth copper. The silver dollar weighs $412\frac{1}{2}$ gr. Find the weight of 1000 silver dollars. Find the amount of silver and copper respectively in 500 silver dollars. Express answers in pounds, ounces, etc.

9. How many ounces in .325 of a ton?

10. How many grains in $\frac{7}{16}$ lb. Apothecaries' weight?

11. How many grains in $.87\frac{1}{2}$ of a pound Troy? $87\frac{1}{2}\%$ of a pound Avoirdupois?

12. 50 lb. Troy are equal to how many pounds Avoirdupois?

13. Reduce 8.28 lb. Troy to integers of lower denominations.

14. How much are $1\frac{3}{4}$ T. of sugar worth at $6\frac{7}{8}$ ¢ a pound?

15. Which is heavier, a pound of iron or a pound of silver? How much?

16. Which is heavier, and how much, an ounce of iron or an ounce of silver?

17. How much are 12,060 lb. of wheat worth at $\$ \frac{5}{8}$ a bushel?

18. From $62\frac{1}{2}\%$ of 1 lb. Troy take $5\frac{1}{4}$ oz. Troy.

19. Change 627,200 oz. of flour to barrels.

20. If a ton of sugar is worth \$135, how much will 5 cwt. 36 lb. cost?

LESSON 23

The unit of Time is the *day*.

The *Solar Year* is the exact time of the revolution of the earth around the sun. It contains nearly 365 da. 5 hr. 48 min. 46 sec.

As it is not convenient to reckon a fraction of a day in the year, we disregard the *fourth of a day* for 3 years, and add 1 day to February every fourth year. Hence we have 3 years of 365 days called *civil years*, and then 1 year of 366 days called *leap year*. By so doing we gain in 100 years about 5 hours less than a day. We rectify this by making most centennial years common years instead of *leap years*; but the 5 hours less than a day amounts in 400 years to nearly a full day. This we rectify by counting every 400th year a leap year.

Hence, years divisible by 4, except centennial years, are leap years; and centennial years divisible by 400 are also leap years.

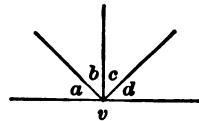
1. Name the calendar months and state the number of days in each.
2. Name the months constituting each season.
3. Tell which are leap years: 1896; 1600; 1700; 1800; 1900; 1901; 1902; 1903; 1904; 2000; 1500; 1908.
4. How many hours in 1200 sec.? In 80 min.? In 35 min.? In .25 min.?
5. Change 25 da. 12 hr. 20 min. to minutes.
6. In 38,767 hr. how many days?
7. Change .26 of a common year to integers of lower denominations.
8. Change $\frac{3}{8}$ of a common year to integers of lower denominations.
9. Reduce to days: $14\frac{2}{3}$ hr.; 5.5 wk.
10. A note, dated July 24th, is due 60 days after date. When does it become due?

11. Change 45 da. 18 hr. to the decimal of a leap year.
12. To $\frac{1}{6}$ of a common year add $\frac{1}{6}$ of a leap year.
13. From 3 yr. 5 da. 18 hr. take 166 da. 14 hr. 32 min.
14. Divide 38 wk. 5 da. 18 hr. 21 min. 46 sec. by 7.

LESSON 24

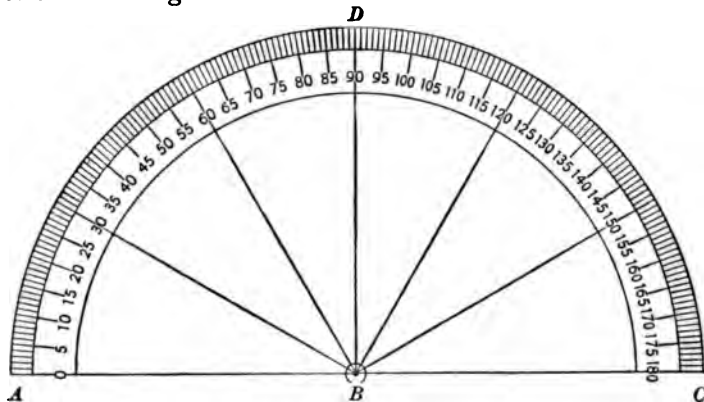
Circular Measure is used in measuring angles, in determining latitude and longitude, etc.

When two straight lines are drawn from the same point, the opening between the lines is called an angle. Thus a , b , c , and d are angles. Their vertex is v .



The two straight lines are called the sides of the angle. The size of an angle depends wholly upon the difference in the direction of the sides, and not upon the length of the sides.

A **Protractor** is an instrument used to determine the size of an angle.

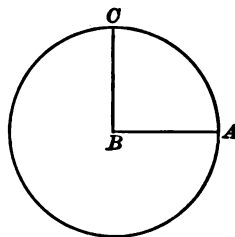


A PROTRACTOR.

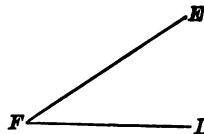
For the purpose of measuring angles the circumference is supposed to be divided into 360 equal parts called degrees ($^{\circ}$). The degree is the unit of circular measure.

A protractor may be made out of cardboard or stiff paper.

To measure an angle its vertex is made the center of a circle, and the arc included between its sides is the "size," or measure, of the angle. Thus the angle ABC is measured by the arc AC . As the arc AC is $\frac{1}{4}$ of the circumference, the angle ABC is $\frac{1}{4}$ of 360° , or 90° .



To measure the angle DFE , for example, place the point B of the protractor upon the vertex F of the angle, and the edge BC on the side DF . Then notice the number of degrees marked on the rim of the protractor at the point where it is crossed by the side EF .



This will be the number of degrees in the angle, provided the protractor is graduated from right to left; but if the protractor is graduated from left to right, the number on the rim of the protractor must be deducted from 180° to indicate the size of the angle.

LESSON 25

An angle of 90° is called a **Right Angle**. Angles less than right angles are called **Acute Angles**; angles greater than right angles are called **Obtuse Angles**.

The *degree* does not express a fixed length. It is $\frac{1}{360}$

of the circumference of a circle. It varies, therefore, with the size of the circle.

If the circumference of the earth at the equator is divided into 360 equal parts, one of these parts expresses a degree of latitude or longitude at the equator. It is about 69.16 statute miles, or 60 geographical miles.

1. How many degrees in $\frac{1}{2}$ C.? $\frac{1}{4}$ C.? $\frac{3}{5}$ C.? $\frac{1}{24}$ C.? $\frac{5}{36}$ C.?

2. Recite the table of circular measure.

3. How many degrees in $300'$? $180'$? $70'$? $140'$? $5400''$?

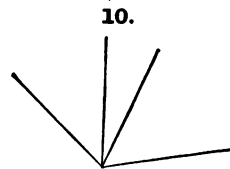
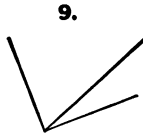
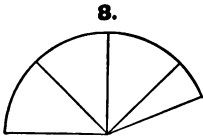
4. What part of a circumference is 180° ? 90° ? 30° ? 45° ?

5. Define right angle ; acute angle ; obtuse angle.

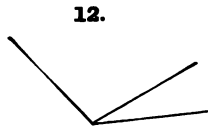
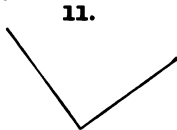
6. How many degrees are there in $\frac{5}{6}$ of a right angle? $\frac{3}{5}$ of a right angle? $\frac{5}{6}$ of a right angle?

7. What part of a right angle is 36° ? 60° ? 80° ? 72° ?

Measure each of the following angles, and add the results.

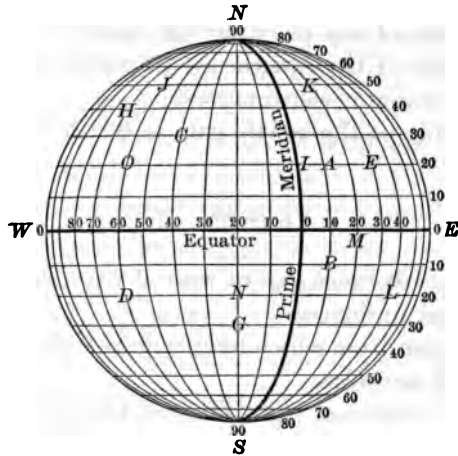


Estimate each of the following angles by the eye, then test your answers with the protractor, noting the correct answers.



LESSON 26

1. Reduce $81^{\circ} 45' 28''$ to seconds.
2. Change $84,672''$ to higher denominations.
3. Find the sum of $24^{\circ} 32' 42''$, $64^{\circ} 55' 38''$, $75^{\circ} 36' 22''$.
4. From $\frac{1}{4}$ of $98^{\circ} 25' 24''$ take $9^{\circ} 59''$.
5. Find the sum of 72.325° , $4.28'$, $29.5''$.
6. Multiply $14^{\circ} 7' 18''$ by 6.
7. Divide $49^{\circ} 17' 24''$ by 6.
8. $10''$ equals what part of a degree?
9. Change $\frac{5}{16}$ of 1° to integers of lower denominations.



The **Equator** is a great circle midway between the north and south poles.

Parallels are small circles parallel to the equator. They indicate the distance of places north or south of the equator.

Meridian Circles are great circles extending through the poles of the earth, perpendicular to the equator and the parallels. They indicate distances east or west of some meridian taken as a standard.

Meridian means *middle of the day*. In all places situated on the same meridian it is noon or midday at the same time.

The position of a place on the earth is indicated:

1. By its distance north or south of the equator.
2. By its distance east or west of a standard meridian.

Latitude is distance north or south of the equator measured along the meridians. It is reckoned in degrees.

The latitude of any place on the equator is latitude 0° .

Places north of the equator are in north latitude; those south of the equator south latitude.

The latitude of the north pole is 90° N.; of the south pole 90° S.

LESSON 27

Longitude is distance east or west of a standard meridian. It is reckoned in degrees.

The meridian from which longitude is reckoned is called the *standard meridian*.

Nearly all countries have adopted the meridian passing through Greenwich, near London, as the standard. Sometimes, however, it is reckoned from the capital of the country, as from Washington or Paris.

The longitude of any place on the *standard meridian* is longitude 0° .

Places not exceeding 180° east of the standard meridian

are in east longitude; places not exceeding 180° west of it are in west longitude.

Since there are only 180° in half a circle, the greatest value of longitude a place can have is 180° .

The value of a single degree of longitude on the equator is equal to about 69.16 miles; at latitude 20° it is about 65 statute miles; at 30° , about 60 miles; at 40° , about 53 miles; at 80° , about 12 miles; at 90° , 0 miles.

(See diagram, p. 35.)

1. What are the names of the lines that extend from east to west on the globe? What are the names of those that extend from the north to the south pole?

2. What is the equator? What are parallels? Meridians?

3. What is latitude? How is latitude measured and reckoned? What is the latitude of all places on the equator? What is the latitude of the poles?

4. What is longitude? How is it reckoned?

5. What is meant by *standard* or *prime meridian*?

6. What meridian has been adopted by nearly all countries as the standard?

7. What is the greatest longitude a place can have?

8. What places have no longitude?

LESSON 28

(Get answers from the diagram, p. 35.)

1. What is the latitude of *A*? Longitude?

2. State the latitude and longitude of *C*.

3. What is the latitude of *B*? What is the difference in latitude between *A* and *B*?

4. What is the difference in longitude between *A* and *E*? *J* and *K*? *A* and *C*? *E* and *K*? *D* and *L*? *D* and *G*?

5. What is the difference in latitude between *B* and *C*? *C* and *J*?

6. What is the latitude of *I*? Longitude?

7. What is the latitude of *M*? Longitude?

8. What is the difference in latitude between *D* and *H*?

9. What is the difference in longitude between *H* and *L*?

10. The latitude of Washington is $38^{\circ} 53' 20''$ north, and of Richmond $37^{\circ} 32' 17''$ north. Find the difference in latitude.

11. The latitude of Savannah is $32^{\circ} 1'$ north, and of Cincinnati $39^{\circ} 6'$ north. What is the difference in latitude?

12. The latitude of New Orleans is $29^{\circ} 57'$ north, and of Quito $13'$ south. Find the difference in latitude.

13. The latitude of New York is $40^{\circ} 42' 43''$ north, and of Rio Janeiro $22^{\circ} 54'$ south. Find the difference in latitude.

14. Boston is $71^{\circ} 3' 58''$, and Washington $77^{\circ} 0' 28''$, west of Greenwich. What is the difference in longitude?

15. New York is $74^{\circ} 0' 3''$, and Omaha 96° , west of Greenwich. Find the difference in longitude.

16. The longitude of St. Paul, Minn., is $93^{\circ} 5'$ west, and of Marseilles, France, $5^{\circ} 22'$ east. What is the difference in longitude?

LESSON 29

Since the earth turns on its axis from west to east once in 24 hours, the sun appears to move from east to west around the earth in the same time. Therefore a circumference (360°) is described by the apparent revolution of the sun around the earth in 24 hours.

Since the sun appears to travel through 360° of longitude in 24 hours, in 1 hour it appears to travel through $\frac{1}{24}$ of 360° , or 15° of longitude; in 1 minute, through $\frac{1}{60}$ of 15° , or $15'$ of longitude; and in 1 second, through $\frac{1}{60}$ of $15'$, or $15''$ of longitude. Therefore we have the following table:

15° of longitude correspond to 1 hour of time.
 $15'$ of longitude correspond to 1 minute of time.
 $15''$ of longitude correspond to 1 second of time.

All places east of a certain point have later time, all places west earlier time. Thus when it is 10 o'clock A.M. in Philadelphia, it is 11 o'clock A.M. at a point 15° east of Philadelphia; 12 o'clock M. 30° east; 1 o'clock P.M. 45° east, etc.

Again, when it is 10 o'clock A.M. in Philadelphia, it is 9 o'clock A.M. 15° west; 8 o'clock A.M. 30° west; 7 o'clock A.M. 45° west, etc.

1. In what direction does the earth rotate on its axis?
2. In what direction and in what time does the sun appear to move around the earth?
3. Through how many degrees of longitude does the earth rotate in 1 day, or 24 hours? In 12 hours? In 6 hours? In 1 hour?
4. How many degrees of longitude correspond to 1 hr. of time? 2 hr.? 3 hr.? 4 hr.?
5. Does the sun appear first to places east or west of us?
6. When it is sunrise at a place 15° east of us, how long will it be before it is sunrise with us?

LESSON 30

1. When it is noon with us, is it earlier or later east of us? West of us?

2. When it is noon at Philadelphia, what time is it at all other places lying on the same meridian?

3. At what places is it midnight when it is noon at Philadelphia?

4. When it is noon at any place, what time is it at a place 15° east? 30° east? 45° east? 90° east? 15° west? 30° west? 45° west?

5. Can you make a rule for finding the difference in time between two places when the difference in longitude is given?

6. The difference in longitude between A and B is 30° . What is the difference in time?

7. If A is west of B , when it is 10 o'clock A.M. at B , what time is it at A ? When it is 2 o'clock P.M. at A , what time is it at B ?

What is the difference in time when the difference in longitude is :

8. 45° ? 11. 5° ? 14. $15'$? 17. $15''$? 20. 35° ?

9. 60° ? 12. 1° ? 15. $45'$? 18. $30^\circ 45'$? 21. 55° ?

10. 90° ? 13. $30'$? 16. $30''$? 19. $45^\circ 30'$? 22. 70° ?

23. Since 15° of longitude equal 1 hour of time, what is the difference in longitude between two places, if the difference in time is 2 hr.? 3 hr.? 4 hr.? $3\frac{1}{2}$ hr.? 30 min.? 45 min.? 15 min.? 2 hr. 20 min.?

24. Can you make a rule for finding the difference in longitude between two places when the difference in time is given?

What is the difference in longitude when the difference in time is :

- | | | |
|---------------------------------|----------------------|----------------------------|
| 25. 4 hr. ? | 29. 6 hr. ? | 33. 45 min. ? |
| 26. 3 hr. ? | 30. 12 hr. ? | 34. 2 hr. 15 min. ? |
| 27. $2\frac{1}{2}$ hr. ? | 31. 1 hr. ? | 35. 3 hr. 45 min. ? |
| 28. 5 hr. ? | 32. 30 min. ? | 36. 15 sec. ? |

(See diagram, p. 35, for the following :)

- 37.** When it is noon at *E* what time is it at *I*? At *A*?
- 38.** When it is 10 A.M. at *C* what time is it at *H*?
- 39.** What time is it at *O* when it is half past 10 o'clock A.M. at *A*?
- 40.** What is the difference in time between *L* and *N*?
- 41.** When it is 7 o'clock A.M. at *N* what time is it at *L*?

GENERAL ANALYSIS

LESSON 31

1. Find the cost of 12 bu. of corn at $\$ \frac{2}{3}$ a bushel.
2. How many bushels of corn can be bought for \$12, at $\$ \frac{2}{3}$ a bushel?
3. If 3 men can do $\frac{2}{3}$ of a piece of work in 6 da., how long will it take them to do the whole of it? How long will it take one man to do it? How long will it take two men to do it?
4. Find the cost of $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$ of a ton of coal, at \$3.20 a ton.
5. How many pints in $37\frac{1}{2}\%$ of a bushel?
6. If $87\frac{1}{2}\%$ of a yard of silk cost \$1.40, how much will 75% of a yard cost?
7. A wagon was sold for $\frac{5}{8}$ of its value, which was at a loss of \$9. At what price was it sold?
8. Find $18\frac{3}{4}\%$ of \$1680. $6\frac{2}{3}\%$ of \$428.50.
9. What must be taken from $16\frac{5}{8}$ to leave $7\frac{1}{8}$?
10. If a man spent $\frac{1}{4}$ and $\frac{3}{8}$ of his money and had \$9 left, how much money had he at first?
11. $33\frac{1}{3}\%$ of a day equals how many hours? 40% of an hour equals how many minutes?
12. If a man sold 10 out of a hundred turkeys, what per cent did he sell? If he had 250 at first, how many did he sell?

13. If a merchant buys an article for \$1.25 and sells it at a gain of 100%, how much does he receive for it?
14. A certain number diminished by $\frac{1}{3}$ of itself equals 22. What is the number?
15. John has 36 marbles, and $\frac{2}{3}$ of John's number equals $\frac{3}{4}$ of $\frac{1}{2}$ of Henry's number. How many marbles has Henry?
16. At \$5 a ton, how many pounds of coal can you buy for \$3?
17. Find the cost of a dozen pairs of shoes, if 3 pairs cost \$9 $\frac{3}{4}$.
18. A man owned $\frac{3}{8}$ of a farm and sold $\frac{3}{4}$ of his share for \$3600. What was the value of the whole farm?

LESSON 32

1. A man can do a piece of work in $16\frac{2}{3}$ days. What part of it can he do in $6\frac{3}{4}$ da.?
2. What part of 6 is 5? 9 is 6? $\frac{1}{2}$ is $\frac{1}{4}$? 3 is $\frac{1}{3}$?
3. What part of $2\frac{1}{2}$ is $\frac{1}{2}$? $1\frac{2}{3}$ is $\frac{1}{3}$? $\frac{7}{8}$ is $\frac{1}{4}$? $8\frac{1}{3}$ is $\frac{2}{3}$?
4. If $\frac{3}{8}$ of a dozen bananas cost 12¢, how much will $1\frac{3}{4}$ dozen cost?
5. $\frac{3}{5}$ of 100 equals 25% of what number?
6. How much will $3\frac{1}{2}$ bbl. of apples cost, if $1\frac{1}{2}$ bbl. cost \$3.60?
7. How many barrels will be needed to hold 50 bu. of potatoes, if 1 bbl. holds $2\frac{1}{2}$ bu.?
8. Find the interest of \$800 for 2 yr. 3 mo. 10 da. at 6%.
9. .75 is what part of 3.25?
10. What part of a mile is 880 yd.? 830 yd.? 4500 ft.?

11. What part of a ton is 480 lb.? 8.5 cwt.? 12 cwt. 50 lb.?
12. Find the cost of 15 yd. of cloth if $5\frac{1}{2}$ yd. cost \$20 $\frac{1}{2}$.
13. How far will a man walk in $4\frac{1}{3}$ hr. at the rate of 14 mi. in $3\frac{1}{2}$ hr.?
14. Mary sold 3 eggs more than $\frac{2}{3}$ of a dozen and had $\frac{1}{3}$ of a dozen left. How many eggs had she before she sold any?
15. What must be paid for 18 boxes of oranges when $\frac{2}{3}$ of a box costs \$1 $\frac{5}{8}$?
16. Walter Johnson can make a gate in $\frac{3}{5}$ of a day. How many gates can he make in 6 days?
17. If I add $12\frac{1}{2}$ lb. to $\frac{3}{4}$ of my weight it will equal 125 pounds. What is my weight?
18. If I can do a piece of work in 20 days, what part of the work can I do in $3\frac{1}{2}$ days?
19. Find the cost of $16\frac{3}{8}$ cords of wood at \$4.87 $\frac{1}{2}$ a cord.

LESSON 33

1. If I can do a piece of work in 6 days, what part of the work can I do in 60 % of a day?
2. I bought a lot of corn for \$400 and sold it at a loss of 5%. Find the loss. Find the selling price.
3. What is the difference between $\frac{5}{8}$ of \$1 and $\frac{1}{8}$ of \$5?
4. What part of 10¢ is $2\frac{1}{2}$ ¢?
5. If you sell an article for \$.12 $\frac{1}{2}$ that cost you \$.10, the gain is what part of the cost? What per cent?
6. If $.12\frac{1}{2}$ of the cost of a coat is \$3 $\frac{1}{8}$, what is the cost of the coat?

7. A man had \$25. He paid $\frac{1}{4}$ of it for a hat and \$12 $\frac{3}{4}$ for a coat. How much money had he left?

8. At \$ $\frac{2}{3}$ a yard, how many yards of satin will \$9 buy? \$6 $\frac{2}{3}$?

9. If 4 $\frac{3}{8}$ lb. of tea cost \$3.15, how much will 3 $\frac{3}{4}$ lb. cost?

10. At \$ $\frac{3}{4}$ a day, how much will a boy earn in the month of August, provided the first day of August comes on Wednesday?

11. A grocer bought 40 bu. of potatoes, but 4 bushels were damaged. What part of them were bad? What per cent?

12. A lady had 36 doz. eggs and sold $\frac{5}{6}$ of them at 15¢ a dozen. How much did she receive for what she sold?

13. A man bought a pair of horses for \$250 and sold them so as to gain 5% of the cost. Find the gain.

14. A is $45^{\circ}30'$ east of B . When it is 10 o'clock A.M. at A , what time is it at B ? When it is 4 P.M. at B , what time is it at A ?

15. If $\frac{3}{4}$ of a pound of coffee is worth \$ $\frac{1}{5}$, how many pounds can be bought for \$4.50?

16. How many yards of lace at \$ $\frac{2}{3}$ a yard can be bought for \$13.50?

17. If 1 $\frac{3}{8}$ lb. of spice cost 30¢, how much will 4 $\frac{3}{8}$ lb. cost?

18. What is the interest of \$50 for 1 yr. at 8%? What is the interest for 9 mo. at 4%?

19. What is the interest of \$200 for 1 yr. at 6%? What is the interest for 6 mo.? For 1 mo.? For 15 da.? For 6 da.?

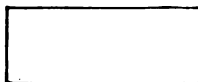
AREAS

LESSON 34

1. Define surface; polygon; triangle; square; rectangle; rhombus; rhomboid; trapezoid.



Square



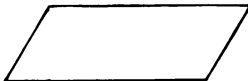
Rectangle



Triangle



Rhombus



Rhomboid



Trapezoid

Any flat surface which is bounded by four lines or edges is called a **Quadrilateral**. The square and the rectangle belong to a particular class of quadrilaterals called parallelograms.

2. In what particular respect are a square and a rectangle alike? In what respect are they unlike?

3. In what respect does a rhombus resemble a square? In what respect is it unlike a square?

4. Draw a rectangle 4 in. long and 3 in. wide. Divide it into square inches by drawing lines. Count the square inches, writing inside each square inch its number from one upward.

Write a rule for finding the area of a rectangle.

5. Draw a rhomboid of any convenient size. Show how it can be changed into a rectangle, keeping the same base and altitude.

Write a rule for finding the area of a rhomboid.

6. Draw a rhombus of any convenient size. Show how it can be changed into a square, keeping the same base and altitude. Write rule for finding the area of a rhombus.

7. Draw a trapezoid of any convenient size. Show how the trapezoid can be changed into a parallelogram, keeping the altitude unchanged. Write rule for finding the area of a trapezoid.

LESSON 35

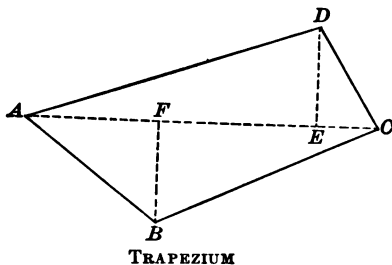
1. Draw a parallelogram (square, rectangle, rhombus, or rhomboid) of any convenient size. Divide it into two parts by a diagonal, state what figure each part is, and show that the parts are equal.

Give rule for finding the area of a triangle.

A **Trapezium** is a quadrilateral having none of its sides parallel.

If the trapezium is divided into two parts by the diagonal AC , it will consist of the two triangles ABC and ACD , the diagonal forming the base of both triangles.

The altitude of the first triangle is BF and of the second DE . Now, it is evident that the area of the trapezium must equal the sum of the areas of the two triangles.



2. Find the area of a piece of land in the form of a parallelogram, whose length is 30 rd. and altitude 25 rd.
3. The base of a rhombus is 30 yd. and altitude 70 ft. Find its area.
4. Find the area of a trapezoid, one side of which is 12 ft., the other 8 ft., and altitude 4 ft.
5. The base of a rhomboid is 30 ch. and the altitude 25 rd. What is its area?
6. The diagonal of a trapezium is 60 ft., and the altitudes of the triangles into which the trapezium is divided are 40 ft. and 30 ft., respectively. Find the area of the trapezium.
7. Since the area of a parallelogram equals the product of its base and altitude, to what is the base equal? The altitude?
8. The area of a parallelogram whose base is 9 ft. is 54 sq. ft. What is its altitude?
9. The area of a parallelogram is 72 sq. ft. If the altitude is 6 ft., what is the base?
10. Define equilateral triangle; isosceles; scalene.
11. What is the area of a triangle whose base is 1 yd. and altitude 2 ft.?

LESSON 36

A **Polygon** is generally defined as any flat surface bounded by straight lines; but the name is usually applied to surfaces which are bounded by more than four lines.

If the lines which bound the surface are all equal to one another, the figure is called an *equilateral polygon*.

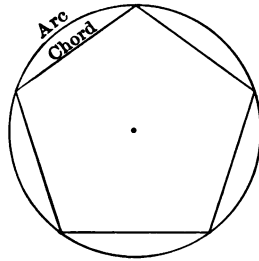
If the angles are all equal to each other, the figure is an *equiangular polygon*.

If the polygon is *equilateral* and *equiangular*, it is called a *regular polygon*.

Regular polygons are most easily constructed with the aid of circles.

To construct a regular polygon of any number of sides, first draw a circle, and, with the aid of compasses or protractor, divide the circumference into as many equal parts (arcs) as the polygon is to have sides; then connect the points of division with straight lines (chords).

For example, to construct a regular polygon of five sides, we first draw a circle, and, with the aid of compasses or protractor, divide the circumference into five equal parts (arcs); we then connect the points of division of the arcs by straight lines (chords) as shown in the accompanying figure at the right.



Polygons are named according to the number of sides. A *pentagon* has *five* sides; a *hexagon*, *six*; a *heptagon*, *seven*; an *octagon*, *eight*.

1. What is a polygon? An equilateral polygon? An equiangular polygon? A regular polygon?

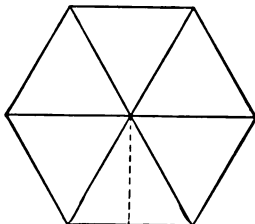
2. How are regular polygons most easily constructed?

3. State how to construct a regular polygon of any number of sides.

4. Define triangle; quadrilateral; square; rectangle; parallelogram; trapezoid; heptagon; pentagon; rhomboid; rhombus; hexagon; trapezium; octagon.

LESSON 37

The center of a regular polygon is the same as the center of the circle within which the polygon is drawn. Any regular polygon may be divided into as many equal triangles as the polygon has sides by connecting the center with each angle of the regular polygon, as follows:

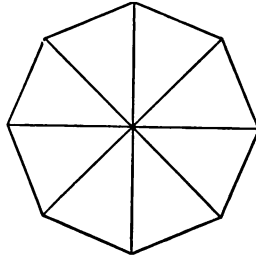


1. Can you formulate a rule for finding the area of a regular polygon?
2. Find the area of the above regular hexagon drawn on a scale of $\frac{1}{8}$ of an inch to a yard.
3. Find the area of the regular pentagon on page 49, drawn on a scale of $\frac{1}{8}$ of an inch to a rod.
4. If you divide the circumference of a circle into four equal arcs and draw chords, what figure will be inscribed? Prove your answer by a drawing. How many degrees will each arc contain?
5. Into how many equal arcs must you divide the circumference of a circle if you wish to inscribe a regular octagon? How many degrees are there in each arc?
6. With the aid of a protractor, inscribe a regular pentagon in a circle. Divide the pentagon into five equal triangles by lines drawn from the center of the circle.

Measure the sides of the triangles, and state whether they are isosceles, scalene, or equilateral.

7. Construct a regular hexagon ; a regular heptagon ; a regular octagon.

8. The figure at the right represents a flower bed drawn on a scale of $\frac{1}{4}$ of an inch to 4 ft. Find its area. How many degrees are there in each angle at the center? Find the perimeter of the octagon. Find the perimeter of each triangle.



LESSON 38

The area of a polygon may be found by dividing it into triangles whose areas are found separately and then added.

1. Find the area of the polygon $ABCDE$ (Fig. 1) from the following measurements :

In the triangle ABC , the base $AC=15$ ft.; the altitude $BF=5\frac{1}{2}$ ft. The triangle CDE equals the triangle ABC .

In the triangle ACE , the base $AE=9$ ft.; the altitude $CG=14\frac{1}{2}$ ft.

2. Find the area of the polygon $ABCDEF$ (Fig. 2) from the following measurements :

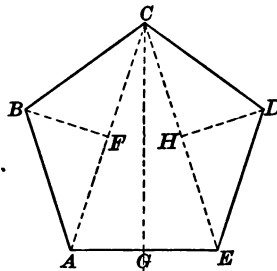


FIG. 1. PENTAGON

In the triangle ABC , the base $AC = 8$ ft.; the altitude $BG = 3\frac{1}{2}$ ft.

In the triangle ACD , the base $AD = 12$ ft.; the altitude $CH = 4$ ft.

In the triangle AED , the base $AD = 12$ ft.; the altitude $EI = 4\frac{1}{2}$ ft.

In the triangle AFF , the base $AE = 7$ ft.; the altitude $FK = 3$ ft.

3. Find the area of the polygon $ABCDEF$ (Fig. 3) from the following measurements:

$BD = 9$ rd.; $CG = 4\frac{1}{2}$ rd.;

$AD = 12$ rd.; $BH = 4$ rd.;

$FK = 5\frac{1}{2}$ rd.; $FD = 8$ rd.;

$EI = 3$ rd.

Sometimes it is easier to divide the polygon into trapezoids, rectangles, and triangles, whose areas are found separately and then added.

4. Find the area of the polygon $ABCDEF$ (Fig. 4) from the following measurements:

$AH = 5$ rd.; $BH = 5$ rd.;

$BC = 4$ rd.; $DK = 6$ rd.;

$DM = 4$ rd.; $EM = 6$ rd.;

$IM = 4$ rd.; $FI = 7$ rd.;

$IN = 5$ rd.; $GN = 4$ rd.;

$AN = 3$ rd.

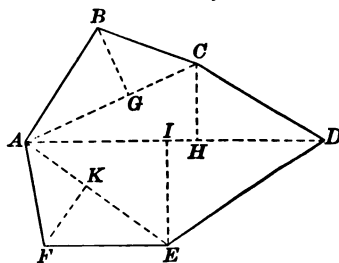


FIG. 2. HEXAGON

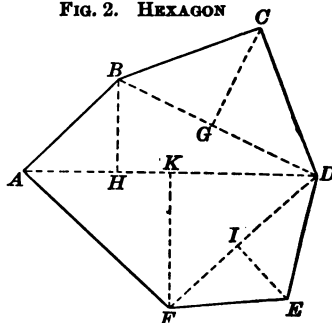


FIG. 3. HEXAGON

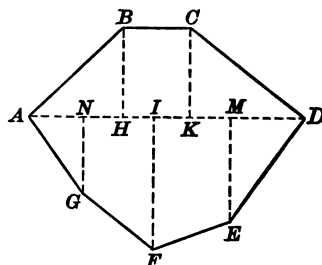


FIG. 4. HEPTAGON

LESSON 39

1. Find the area of the polygon $ABCDEFGH$, drawn on a scale of $\frac{1}{4}$ of an inch to 2 rods.

2. A piece of land 80 rd. long contains 20 acres. How wide is it? Draw a plan on a scale of $\frac{1}{2}$ in. to 20 rd. What is the area of your plan?

3. How wide must a board 12 ft. long be to contain 8 sq. ft.?

4. Find the area of a board 3 ft. long, 9 in. wide at one end, and 6 in. at the other. What figure is represented by this board? Draw a plan on a scale of $\frac{1}{2}$ in. to $\frac{1}{2}$ ft. (See Lesson 78.)

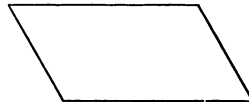
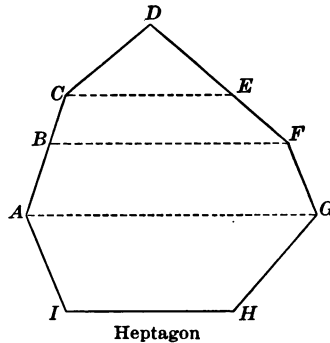
5. How many square feet in a board 16 ft. long, 12 in. wide at one end, and 8 in. at the other?

6. Find the area of a flower bed in the form of a rhombus whose sides are 10 ft. long and whose altitude is 8 ft. Draw a plan on a scale of $\frac{1}{2}$ in. to 2 ft.

7. Find the area of a piece of land having the form of a rhomboid 40 rd. long and 16 rd. wide. Draw a diagram on a scale of $\frac{1}{2}$ in. to 8 ft.

8. Draw a rhomboid on a scale of $\frac{1}{2}$ in. to 20 rd., and find its area.

9. The figure at the right represents the plan of a flower bed, scale $\frac{1}{2}$ in. to 20 ft. Find its area. How much will it cost, at 12¢ a square yard, to spade and prepare it for planting?



LESSON 40

1. With the aid of a string or compasses draw a circle.
2. Draw a diameter and two radii.
3. Write diameter, circumference, radius, arc, each in its proper place.
4. Measure as accurately as you can the length of the circumference and of the diameter, and divide the circumference by the diameter. Compare your quotient with 3.1416.

The exact ratio of a circumference to its diameter cannot be accurately expressed in numbers. Mathematicians have agreed to denote it by the Greek letter π (pronounced pie). π is very nearly equal to 3.1416. If the diameter of a circle is 4 in., the circumference will be 4π , or about 4 times 3.1416.

Make the following calculations, considering the length of the circumference to be π times the diameter :

5. Diameter = 2 in. ; circumference = ?
6. Diameter = 4 in. ; circumference = ?
7. Radius = 3 in. ; circumference = ?
8. Radius = $2\frac{1}{2}$ in. ; circumference = ?
9. Circumference = 6 in. ; diameter = ? Radius = ?
10. Circumference = 9 in. ; diameter = ? Radius = ?
11. Circumference = 12 in. ; diameter = ? Radius = ?
12. Draw a figure to show that a circle may be regarded as composed of a very large number of triangles, the sum of whose bases is the circumference of the circle, and the radius of the circle their common altitude.

13. How do you find the area of a triangle? How may the rule for finding the area of a triangle be applied in finding the area of a circle?

14. Find the area of a circle whose diameter is 4 inches and circumference 12.5664 inches.

LESSON 41

Make the following calculations :

1. Radius = 4 in. ; diameter = ? Circumference = ?

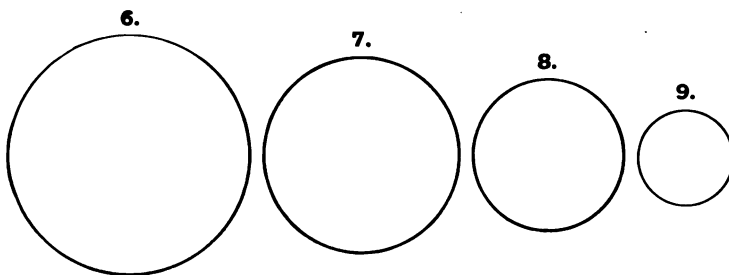
2. Diameter = 6 in. ; radius = ? Circumference = ?
Area = ?

3. Diameter = 8 in. ; radius = ? Circumference = ?
Area = ?

4. Circumference = 12 ft. ; diameter = ? Radius = ?
Area = ?

5. Circumference = 30 yd. ; diameter = ? Radius = ?
Area = ?

Find the diameter, radius, circumference, and area of each of the following circles, drawn on a scale of $\frac{1}{2}$ in. to 24 feet :



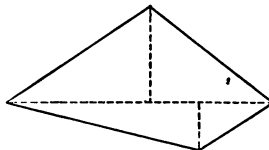
10. Draw on paper a rhomboid whose sides are 4 in. and 3 in., and altitude $2\frac{1}{2}$ in. Find its area.

11. Cut the rhomboid out from the paper, and change it into a rectangle, keeping the same base and altitude. Find area, and compare it with the area of the rhomboid.

12. Draw on paper a trapezoid, making its parallel sides 3 in. and 4 in., and altitude 2 in. Find its area.

13. Cut the trapezoid out from the paper, and change it into a rectangle. Find area, and compare it with the area of the trapezoid.

14. Compute the area of the trapezium at the right, drawn on a scale of $\frac{1}{4}$ of an inch to 10 rods.



15. Find the value, at \$50 an acre, of a piece of land having the shape of a trapezium, the diagonal of which is 40 rd., and the perpendiculars from this diagonal to the opposite corners 16 rd. and 18 rd. respectively.

16. Draw two trapeziums of different shapes, making the diagonal of each 3 in., and the perpendiculars from this diagonal to the opposite corners 2 in. and $1\frac{1}{2}$ in. respectively. Find the area of each.

VOLUMES

LESSON 42

A **Solid** is that which has three dimensions,—length, breadth, and thickness or height.

The **Volume** of a solid is the quantity of space it occupies, and is expressed by the number of times it contains a cubic unit used as a measure.



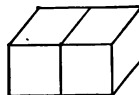
CUBIC UNIT

1. Name three cubic unit measures. Describe each.
2. In what particular respect are they alike? Wherein do they differ?

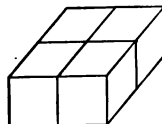
3. How many sides has each? How many edges? How many corners?



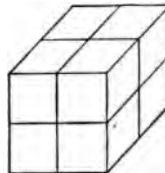
4. What is the volume of a solid one inch long, one inch wide, and one inch high?



5. What is the volume of a solid two inches long, one inch wide, and one inch high?



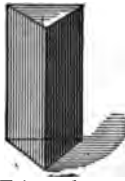
6. What is the volume of a solid two inches long, two inches wide, and one inch high?



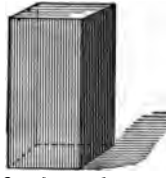
7. What is the volume of a solid two inches long, two inches wide, and two inches high? How many cubic inches in each layer? How many layers?

A **Prism** is a solid whose sides are parallelograms, and whose ends or bases are equal polygons parallel to each other.

A prism is named from the form of its base as triangular, square, quadrangular, pentagonal, etc.



Triangular
Prism



Quadrangular
Prism



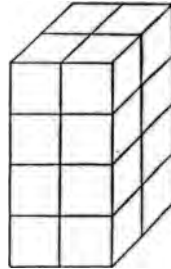
Pentagonal
Prism

8. Find the volume of a quadrangular prism whose bases are 2-inch squares and height 4 inches.

9. How many cubic inches in each layer? How many layers are there?

10. Can you give a rule for calculating the volume of a prism when you know its dimensions?

11. Is it true that the volume of a prism equals the area of the base multiplied by the altitude?



12. What is the volume of a cube whose edge is 5 inches?

LESSON 43

1. What is the volume of a prism whose base is 4 ft. by 3 ft., and height 6 ft.?

2. How many cubic feet in a pile of wood 8 ft. long, 4 ft. wide, and 4 ft. high? Such a pile is called a *cord*.

3. How many cubic feet in a stone wall $16\frac{1}{2}$ ft. long, $1\frac{1}{2}$ ft. thick, and 1 ft. high? Such a wall is called a *perch of stone*.

4. How many perches of stone in a wall 32 ft. long, 6 ft. high, and 18 in. thick?

5. How many cords of wood in a pile 16 ft. long, 4 ft. wide, and 6 ft. high?

6. A pile of wood 32 ft. long and 4 ft. wide contains 768 cu. ft. Find its height.

7. How many cubic inches in a 12-inch cube?

8. How many 2-inch cubes will be needed to build a cube with an edge of 6 inches?

9. Which will hold the more, 4 cubical boxes with 5-inch edges, or 5 cubical boxes with 4-inch edges?

10. How many bricks 8 in. \times 4 in. \times 2 in. will it take to build a wall 20 ft. long, 8 ft. high, and 18 in. thick?

11. Find the volume of a triangular prism whose altitude is 6 ft. and the area of whose base is 336 sq. in.

12. What must be the altitude of a rectangular prism to contain 216 cu. in. if its bases are 4 in. by 6 in.?

13. Find the volume of a hexagonal prism whose sides are each $12\frac{1}{2}$ in., altitude 10 ft., and perpendicular distance from the center of the base to one side 5.47 in.

14. How many 2-inch cubes can be cut from a block of wood 8 in. \times 4 in. \times 4 in., not considering loss in cutting?

15. A ton of coal is equal to 36 cu. ft. How many tons can be put into a bin 6 ft. long, 16 ft. wide, and $8\frac{1}{2}$ ft. deep?

LESSON 44

1. If an *inch cube* is placed upon a flat surface, as a table, how many square inches of surface will it cover?

2. How many inch cubes will cover two square inches? Three square inches? Four square inches?

3. Is it true that the number of *cubic inches* in a prism 1 in. high equals the number of *square inches* in the base of that prism?

4. Is it true that the number of cubic inches in a cylinder 1 in. high is the same as the number of square inches in the base?

It is evident from the accompanying figure that a cylinder, for example, 5 in. high, will contain 5 times as many cubic inches as a cylinder 1 in. high.

5. Can you formulate a rule for finding the volume of a cylinder?

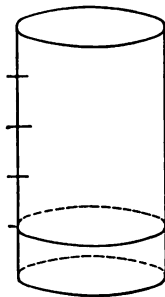
6. Find the volume of a cylinder the area of whose base is 25 sq. ft. and altitude 16 ft.

7. How many cubic feet of earth must be taken out in digging a well 30 ft. deep and 6 ft. in diameter?

8. What is the volume of a cylinder whose altitude is 5 ft. and diameter of whose base is 3 ft.?

9. What is the volume of a cylinder whose height is 5 ft. and the diameter of the base 10 in.?

10. Find the volume of a cylinder whose altitude is 8 ft. 6 in. and the diameter of the base 4 ft.



11. How many cubic feet in a street roller $6\frac{1}{2}$ ft. long and $8\frac{1}{2}$ ft. in diameter?

12. Find the volume of a cylinder whose altitude is $16\frac{1}{2}$ ft. and the diameter of whose base is 3 ft.

LESSON 45

1. How many cubic feet are there in a log 25 ft. long and 16 in. in diameter?

2. Find the number of cubic feet in a log 28 ft. 6 in. long and 7 ft. round.

3. Find the volume of a triangular prism whose altitude is 30 ft. and the base a right-angled triangle, with sides about the right angle 8 ft. and 6 ft. respectively.

4. The base of a prism 18 ft. high is a rectangle whose sides are 8 ft. and 12 ft. Find its volume.

5. What must be the length of a block of marble 8 in. wide and 4 in. thick to contain 512 cu. in.?

6. A well is 20 ft. deep and 4 ft. in diameter. How many cubic feet of water are there in it if it is $\frac{1}{2}$ full?

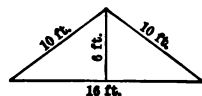
7. Find the contents, or volume, of a rectangular prism $12\frac{1}{2}$ ft. by 4 ft. by 6 ft.

8. In digging a cellar 50 ft. long and 20 ft. wide, 6000 cu. ft. of earth were taken out. How deep was it?

9. Find the entire surface of a piece of granite $5\frac{1}{2}$ ft. long, 3 ft. wide, and 2 ft. thick. Find its volume.

10. A circular ice pond 25 rd. in diameter is covered with ice 8 in. thick. How many cubic feet of ice are there on the pond?

11. The isosceles triangle at the right is the base of a prism 20 ft. high. Find its volume and convex surface.



REVIEW WORK

LESSON 46

1. Describe a cylinder.
2. If $\frac{3}{4}$ of a ton of hay is sold for \$9, how much will 2 T. 5 cwt. cost?
3. How much will 54 eggs cost at 22¢ a dozen?
4. If 4 men can do $\frac{3}{4}$ of a piece of work in a day, how long will it take one man to do $\frac{1}{4}$ of the work?
5. If 7 yd. of cloth cost \$5 $\frac{1}{4}$, how much will $\frac{3}{8}$ yd. cost?
6. If a bushel of corn is worth 64¢, how much will a pint cost?
7. What is 33 $\frac{1}{3}$ % of \$3.75? Of \$33 $\frac{1}{4}$? Of \$90.93?
8. If I buy eggs at 20¢ a dozen and sell them at 25¢ a dozen, the gain is what part of the cost? What per cent of the cost?
9. A man bought 85 bu. of wheat at 60¢ a bushel. He sold 25% of it at 56¢ a bushel, 50% of it at 64¢ a bushel, and the rest at cost. Find his gain.
10. A grocer bought potatoes at 60¢ a bushel and sold them at 75¢ a bushel. With the gain on 235 bu. he purchased sugar at 7 $\frac{1}{2}$ ¢ a pound. How many pounds did he get?
11. I have a garden 12 rd. long and 9 rd. wide. How much will it cost to fence the garden at \$1.37 $\frac{1}{2}$ a rod?

12. When it is 9.30 o'clock at A , what time is it at a point 35° east of A ? What time 35° west of A ?
13. Add $7\frac{1}{2}$, $65\frac{1}{2}$, $.725$, $9\frac{2}{3}$, $.85\frac{1}{2}$, 64.32 , $72\frac{3}{8}$.
14. A tank 18 ft. long, 15 ft. wide, contains 60 cu. yd. Find its depth in feet.

LESSON 47

1. How much will 6 qt. 1 pt. of chestnuts cost at \$2.56 a bushel?
2. If $\frac{3}{8}$ lb. of cheese are worth 12¢, how much will $3\frac{1}{2}$ lb. cost?
3. 60 ft. = how many fathoms?
4. A man bought a flock of sheep and sold $\frac{1}{4}$ of them to a butcher. He afterward bought 13, and then had 43 sheep. How many sheep did he buy at first?
5. A certain number increased by $\frac{2}{5}$ of itself equals 40. What is the number?
6. What is .15 of \$80? 15% of \$200?
7. Divide $\frac{2}{3}$ by $\frac{3}{4}$; $\frac{4}{5}$ by $\frac{7}{8}$; $\frac{9}{10}$ by $\frac{3}{4}$ of $\frac{1}{2}$.
8. If $\frac{1}{3}$ of my age is 14 yr., what is my age?
9. If the interest on the money I owe is \$2 for $\frac{2}{3}$ of a month, what is the interest for $\frac{2}{3}$ of a year?
10. $8\frac{1}{3}$ is what part of 25? $\frac{2}{3}$ of 21 is $\frac{2}{3}$ of the number of marbles John has. How many marbles has John?
11. How much is a peck of clover seed worth at 8¢ a pound?
12. What part of a peck is .02 bu.? Change .05 gal. to the fraction of a quart.
13. Change 146780 min. to higher denominations.

14. Owning $\frac{5}{8}$ of a grocery store, I sell $\frac{3}{8}$ of my share for \$2360. How much is the store worth?

15. I bought 6400 chestnut fence posts for \$400. What is the price per C.?

16. What is the price per bushel when $87\frac{1}{2}\%$ of a bushel sells for 49¢?

17. Find the cost of 9360 feet of boards at \$15.75 per M.

18. Find the cost of .8 of $6\frac{1}{2}$ T. of hay at \$10.75 per ton.

LESSON 48

1. Name the coins in common use.

2. How many mills in $6\frac{3}{4}$ ¢? In $\frac{3}{8}$ of a dime?

3. Recite the table of English money.

4. £1 equals how many dollars? 1 shilling how many cents? 1 penny how many cents?

5. At $\frac{5}{8}$ ¢ each, how many pencils can be bought for \$1.50?

6. What part of a ton is a hundredweight? What per cent of a ton is 100 lb.?

7. Find the cost of 2.4 pints of oil at 80¢ a gallon.

8. Find the cost of $\frac{3}{8}$ of a gallon of molasses at 5¢ a pint.

9. Find the cost of $2\frac{3}{4}$ pk. of beans at 60¢ a bushel.

10. How many cubic inches are there in a gallon? In a quart?

11. How many cubic inches are there in a bushel? In a peck? In a quart?

12. A peck is what per cent of a bushel?

13. How much will 60 yards of wire fencing cost at \$1.20 a rod?

14. How many square feet in $22\frac{2}{3}\%$ of 2 sq. yd.?
15. Change $15\frac{1}{8}$ cu. ft. to cubic yards.
16. The distance from Wilkesbarre to Albany is 192 miles. The fare is \$6.72. What is the rate per mile?
17. The difference in time between two places is 2 hr. 20 min. What is the difference in longitude?
18. The difference in longitude between two places is 48° . What is the difference in time?
19. Find the cost of 17,600 laths at $32\frac{1}{2}$ ¢ per C.
20. How much will .8 of a ream of paper cost at .4 of a cent a sheet?
21. A dealer bought shingles at \$3.75 per M., and sold them at \$3.95. How much did he gain on 50 M.?

LESSON 49

1. 5 is $\frac{1}{4}$ of what number? 5 is 25% of what number?
2. 12 is $\frac{3}{4}$ of what number? 12 is 75% of what number?
3. 9 is $\frac{1}{3}$ of what number? 9 is $33\frac{1}{3}\%$ of what number?
4. 8 is $\frac{1}{6}$ of what number? 8 is $16\frac{2}{3}\%$ of what number?
5. If $66\frac{2}{3}\%$ of a man's money is \$180, how much money has he?
6. If $\frac{1}{3}$ of the value of a horse + $16\frac{2}{3}\%$ of its value equals \$75, what is its value?
7. What is the unit in Liquid Measure? How many cubic inches does it contain?
8. How many bushels of grain can be put into a box 5 ft. long, 4 ft. wide, and 3 ft. deep, allowing $1\frac{1}{4}$ cu. ft. to the bushel?
9. How many times 1.5 is 66?

10. At 1.5¢ each, how many penholders can you get for 33¢?

11. A farmer raised 108 bu. of clover seed and sold $62\frac{1}{2}\%$ of it at \$5.87 $\frac{1}{2}$ a bushel. How much did he receive for what he sold?

12. A man bought a horse for \$150 and sold it at a gain of 15%. How much did he receive for it?

13. At \$3.75 a ton, what is the value of 35% of 1250 tons of coal?

14. Mr. Sanders owned .28 of a piece of land. He sold $\frac{1}{4}$ of his share and had 78.54 acres left. How many acres had he at first, and how many acres were in the entire piece?

15. What is the area of a regular octagon, each of whose sides is 11 ft. and whose perpendicular distance from the center to one side is 12.86 ft.?

LESSON 50

1. A rope increased by $\frac{1}{3}$ of its own length equals 40 ft. What is its length?

2. From $87\frac{1}{2}\%$ of \$8.40 take 75% of \$1.

3. $\frac{3}{4}$ of 44 is $33\frac{1}{3}\%$ of what number?

4. If I sold a cow for \$32 and gained $\frac{1}{5}$ of its cost, how much did the cow cost me?

5. What is longitude? How is it reckoned?

6. What part of a circumference is 240° ? 120° ?

7. What part of a mile is 120 rd.?

8. If $\frac{1}{5}$ of a bushel of corn is worth 42¢, find the cost of $37\frac{1}{2}\%$ of a bushel.

9. A degree equals how many statute miles?
10. How many steps $2\frac{1}{2}$ ft. long will a man take in walking $2\frac{3}{4}$ mi.?
11. If 8.125 yd. of cloth cost \$13, now much will 11.25 yd. cost?
12. A field is 65 rd. long, and contains 21.125 A. Find the width of the field, also the cost of fencing it, at 75¢ a rod.
13. Reduce \$1260 to English money.
14. From $\frac{3}{4}$ of a mile subtract $\frac{8}{9}$ of a rod.
15. Find the time from Aug. 25, 1900, to Sept. 11, 1901.
16. Find the exact number of days from May 24 to Nov. 19 of the same year.
17. A box is 9 ft. square and 5 ft. deep. How many bushels will it hold, allowing 4 bu. to occupy 5 cu. ft.?
18. Add 25 rd. 4 yd. 2 ft., 4 yd. 7 in., 85 rd. 3 yd. 2 ft., 3 yd. 2 ft. 9 in.

LESSON 51

1. At $2\frac{1}{4}$ ¢ a pound, how much will 3 bbl. of flour cost?
2. There are 6.25 A. in a rectangular field $31\frac{1}{4}$ rd. wide. How long is it?
3. A field containing 50.875 A. is 18.5 ch. wide. How long is it?
4. What is the area of a semicircle whose radius is 24 in.?
5. By selling apples at \$2.80 a barrel I gain $\frac{3}{11}$ of their cost. At what price per barrel must I sell them to gain $\frac{2}{5}$ of their cost?

6. If 3.2 tons of hay cost \$48, how much will 5.66 $\frac{2}{3}$ tons cost?

7. A carpenter can build a fence 20 rd. long in 15 da. What part of the fence can he build in 8 $\frac{1}{4}$ da.? How many rods can he build?

8. How many bushels of potatoes will a 10-acre field produce if each square rod produces 2 $\frac{1}{2}$ bu.?

9. Change to decimals: $\frac{1}{8}$; $\frac{7}{8}$; $\frac{3}{4}$; 6 $\frac{2}{3}$; 6 $\frac{3}{8}$.

10. State the value of each in hundredths: $\frac{1}{2}$; $\frac{1}{3}$; $\frac{1}{4}$; $\frac{1}{5}$; $\frac{2}{3}$; $\frac{3}{4}$; $\frac{4}{5}$; $\frac{1}{8}$; $\frac{3}{8}$.

11. $8.2 + 1.8 = ?$ $3.7 + 7.3 = ?$ $\frac{2}{3} + 33\frac{1}{3}\% = ?$ $87\frac{1}{2}\% - \frac{1}{8} = ?$ $1.1 + .99 = ?$ $6\frac{1}{4} + 3.25 = ?$ $20 - 4.25 = ?$

12. $1.2 + 3 = ?$ $.3 + 2 = ?$ $.3 + 8 = ?$ $3.6 + 9 = ?$
 $\frac{2}{3} + .3 = ?$

13. I bought a calf for \$4 $\frac{1}{2}$ and sold it to a butcher for \$5 $\frac{1}{8}$. How much did I gain?

14. If $\frac{3}{8}$ of a bushel of plums cost 60¢, how much will 2 $\frac{1}{2}$ bu. cost?

LESSON 52

1. At \$ $\frac{3}{4}$ a yard, how many yards of silk can I buy for \$4 $\frac{1}{2}$? \$6? \$9?

2. If .4 of a pound of cheese cost 8¢, how much will 4.5 lb. cost?

3. What part of 320 is 32? What per cent of 320 is 32?

4. I bought butter at 20¢ a pound and sold it at a gain of 10%. How much did I receive for it?

5. How many rods are there in 44 yd.? In 66 ft.?

6. When butter is worth 32¢ a pound, how much must be paid for 1 lb. 13 oz.?

7. One nickel is what per cent of a dime? Of a quarter?

8. $\frac{2}{5}$ of 65 is $66\frac{2}{3}\%$ of what number?

9. Divide $\frac{1}{5}$ by $\frac{2}{7}$; $3\frac{1}{3}$ by $\frac{1}{4}$; $4\frac{1}{3}$ by $\frac{1}{6}$; $\frac{1}{6}$ by $4\frac{1}{3}$.

10. What is a composite number? A prime number?

11. One dozen is what per cent of a gross?

12. What is a quadrilateral? A rhomboid?

13. What is the area of a trapezoid whose parallel sides are 12 in. and 18 in. respectively, the distance between them being 20 in.?

14. Draw on paper a trapezoid 4 in. long and 3 in. wide. Cut it out from the paper, and from it construct a rectangle of equal magnitude.

15. Draw on paper a rectangle 3 in. long and 2 in. wide. Cut it out, and from it construct a trapezoid of equal magnitude.

16. If $\frac{2}{3}$ yd. of cloth cost \$8, how much will $3.33\frac{1}{3}$ yd. cost?

17. What is the distance, in degrees, between two places whose difference in time is $1\frac{1}{2}$ hr.?

18. A room is $\frac{3}{4}$ as wide as it is long. If its length is 16 ft., how many square feet are there in the floor?

19. How many rings, each $2\frac{1}{2}$ pwt., can be made from 25% of a pound of gold?

20. Find the entire surface of a block 12 in. by 6 in. by 4 in.

21. How much will it cost to dig a cellar 48 ft. long, 24 ft. wide, and 6 ft. deep at 22¢ a cubic yard?

LESSON 53

1. Mr. Harrison sold his horse for \$220, which was $\frac{5}{4}$ of its cost. Find its cost.
2. How many inches are there in $\frac{3}{16}$ of a mile?
3. If 17 yd. of silk cost \$23.80, how much will $12\frac{3}{4}$ yd. cost?
4. Reduce £140 10s. 8d. to United States money.
5. At $37\frac{1}{2}$ ¢ a yard, how many yards of ribbon can be bought for \$ $\frac{3}{16}$?
6. I bought 1 pk. 2 qt. 1 pt. of huckleberries for 84¢. At what price per quart must they be sold to gain $12\frac{1}{2}\%$?
7. A man earned \$16 $\frac{1}{4}$ in $7\frac{1}{2}$ days. At the same rate, how much could he earn in $9\frac{3}{8}$ days?
8. How many half-inch cubes are there in a block 12 in. long, 8 in. wide, and 6 in. thick?
9. Write in words: 8,406,701,015; 84.04016 $\frac{2}{3}$.
10. At $1\frac{1}{2}$ ¢ a sheet, what will be the cost of a quire of paper?
11. If 11¢ is $11\frac{1}{9}\%$ of the cost of a basket of peaches, how much will 2 baskets cost?
12. How many dozen eggs at 12¢ a dozen will pay for 8 yd. of gingham at $16\frac{1}{2}$ ¢ a yard?
13. How many score in 20 doz.?
14. If 20 men do a piece of work in 12 days, in how many days can 15 men do it?
15. $\frac{1}{2}$ mile is what part of 2 miles? $\frac{1}{2}$ mile is what per cent of 2 miles?
16. \$14 $\frac{2}{3}$ was paid for $2\frac{3}{4}$ yd. of cloth. Find the price per yard.

PERCENTAGE

LESSON 54

State the *per cent* equivalents of the following :

- | | | | |
|---------------|-----------------------|------------------------|------------------------|
| 1. .25 = 25%. | 6. $.33\frac{1}{3}$. | 11. $.08\frac{1}{3}$. | 16. $.87\frac{1}{2}$. |
| 2. .75. | 7. $.16\frac{2}{3}$. | 12. $.83\frac{1}{3}$. | 17. $.11\frac{1}{2}$. |
| 3. .20. | 8. $.66\frac{2}{3}$. | 13. .9. | 18. $.83\frac{1}{3}$. |
| 4. .40. | 9. $.62\frac{1}{2}$. | 14. .6. | 19. 1.4. |
| 5. .35. | 10. .06. | 15. .7. | 20. 2.5. |

State the decimal and per cent equivalents of the following fractions :

21. $\frac{1}{4}$. MODEL. $\frac{1}{4} = .25 = 25\%$ Ans.
- | | | | | | |
|---------------------|---------------------|---------------------|----------------------|---------------------|----------------------|
| 22. $\frac{1}{5}$. | 25. $\frac{3}{8}$. | 28. $\frac{1}{8}$. | 31. $\frac{7}{8}$. | 34. $\frac{4}{5}$. | 37. $\frac{1}{12}$. |
| 23. $\frac{1}{6}$. | 26. $\frac{3}{5}$. | 29. $\frac{3}{8}$. | 32. $\frac{4}{10}$. | 35. $\frac{1}{9}$. | 38. $\frac{1}{16}$. |
| 24. $\frac{3}{4}$. | 27. $\frac{1}{2}$. | 30. $\frac{5}{8}$. | 33. $\frac{2}{3}$. | 36. $\frac{5}{6}$. | 39. $\frac{1}{3}$. |

State the fractional equivalents of the following :

40. 75%. MODEL. $75\% = \frac{3}{4}$ Ans.
- | | | | |
|-------------------------|-------------------------|------------------------|-------------------------|
| 41. 25%. | 45. $66\frac{2}{3}\%$. | 49. $6\frac{1}{4}\%$. | 53. $11\frac{1}{3}\%$. |
| 42. 30%. | 46. $37\frac{1}{2}\%$. | 50. 80%. | 54. $62\frac{1}{2}\%$. |
| 43. 40%. | 47. $87\frac{1}{2}\%$. | 51. 60%. | 55. 90%. |
| 44. $33\frac{1}{3}\%$. | 48. $12\frac{1}{2}\%$. | 52. $8\frac{1}{3}\%$. | 56. $22\frac{2}{3}\%$. |
57. What is 5% of 2000 pounds of hay?

MODEL. $5\% = \frac{5}{100}$, or $\frac{1}{20}$. $\frac{1}{20}$ of 2000 pounds = 100 pounds Ans.

Find :

- | | |
|-----------------------------------|-------------------------------------|
| 58. 20% of \$80. | 64. $87\frac{1}{2}\%$ of 96 apples. |
| 59. 4% of 100 bu. | 65. 1% of 300 yd. |
| 60. $12\frac{1}{2}\%$ of 400 lb. | 66. $\frac{1}{3}\%$ of 300 ft. |
| 61. 7% of 320 in. | 67. $\frac{2}{3}\%$ of 600 mi. |
| 62. $16\frac{2}{3}\%$ of \$12.24. | 68. $\frac{1}{4}\%$ of 800 qt. |
| 63. $37\frac{1}{2}\%$ of 80 gal. | 69. $\frac{3}{4}\%$ of 1600 cwt. |

70. A man bought potatoes at 40¢ a bushel and sold them for 20% more than he paid for them. For how much per bushel did he sell them?

71. I paid \$30 for a bicycle and sold it at a gain of $33\frac{1}{3}\%$. Find the gain.

72. A dealer bought coal at \$3.25 per ton and sold it at a gain of 4%. How much was gained on each ton?

73. A rectangular piece of land is 30 ft. long. Its width is $66\frac{2}{3}\%$ of its length. Find the area of the rectangle.

LESSON 55

1. What is 85% of 4620 acres of land?

MODEL. $85\% = .85$. $4620 \text{ A.} \times .85 = 3927 \text{ A.}$ Ans.

What is :

- | | |
|--|---------------------------------------|
| 2. 46% of 325 bbl.? | 10. $\frac{2}{3}\%$ of 336 tons? |
| 3. 53% of \$3060? | 11. $\frac{3}{4}\%$ of 640 rods? |
| 4. 15% of 360 mi.? | 12. $\frac{2}{5}\%$ of \$375? |
| 5. 75% of 300 cows? | 13. $\frac{3}{8}\%$ of \$2.48? |
| 6. $55\frac{1}{3}\%$ of 270 gal.? | 14. $11\frac{1}{6}\%$ of 2980 inches? |
| 7. $84\frac{2}{3}\%$ of \$29.89? | 15. $83\frac{1}{3}\%$ of 4500 hours? |
| 8. 75% of a gross of pens? | 16. 125% of 1600 years? |
| 9. $87\frac{1}{2}\%$ of 3 score and ten? | 17. 160% of \$260? |

18. Find the value of 25% of 420 bu. of potatoes at $42\frac{3}{4}$ ¢ per bu.

19. At $33\frac{1}{3}$ ¢ a bushel, how many bushels of apples can you buy for 34% of \$250?

20. A man earned in a year \$900. If he paid 30% for board and clothing, and 10% for other expenses, how many dollars had he remaining?

21. A man having \$15,380 invested 15% of it in land, 30% of it in a coal mine, and the remainder in city building lots. How many dollars did he invest in each?

22. $18\frac{3}{4}$ % of 38 bu. = how many bushels, pecks, quarts?

23. $11\frac{1}{3}$ % of 26 lb. Troy = how many pounds, ounces, pennyweights, grains?

24. What is $\frac{5}{12}$ % of \$9330?

25. A dealer bought a gross of slates for \$39.60 and sold them at a profit of 20%. Find the selling price of each slate.

26. A man dying left \$11,280 to be divided among his six children. 65% of the money was to be equally divided between his two sons, and the remainder was given in equal shares to his four daughters. Find the share of each son and daughter.

LESSON 56

1. 10% of a number is what part of the number?

2. If 10% of the money a man paid for a hat is 25 ¢, how much did he pay for the hat?

3. $12\frac{1}{2}$ % of a number is what part of it?

4. If $12\frac{1}{2}\%$ of the number of geese a man raised is 22, find the number of geese.
5. 72 acres equals $33\frac{1}{3}\%$ of the number of acres in a farm. How many acres are there in the farm?
6. How can you find the whole quantity from 25% of it? From $66\frac{2}{3}\%$ of it? From $37\frac{1}{2}\%$ of it?
7. If 25% of a quantity of corn is 36 bu., find the whole quantity.
8. If a farmer sold $62\frac{1}{2}\%$ of his potatoes, what per cent of his potatoes remained?
9. After a farmer sold $62\frac{1}{2}\%$ of his potatoes he had 36 bu. remaining. How many bushels had he at first?
10. \$7 $\frac{1}{2}$ is 60% of the cost of an overcoat. Find the price of the coat.
11. 2 $\frac{1}{2}$ yr. is $16\frac{2}{3}\%$ of a young man's age. What is his age?
12. If 60 is 2% of a number, what is the number?
13. Name the number of which 32 is 8%.
14. If 21 lb. is 35% of the weight of a bushel of wheat, what is its weight?
15. 125 is 25% of what number?

OPERATION If 125 is 25% of a certain number, it is .25 of it. If a certain number multiplied by .25 gives a product of 125, it is evident that the number must equal 125 divided by .25 or 500.

$$125 \div .25 = 500 \text{ Ans.}$$

16. 112 is 8% of what number?
17. 360 is 30% of what number?
18. 640 is 32% of what number?
19. 300 is $33\frac{1}{3}\%$ of what number?

20. 720 is 36% of what number?
21. 840 is 14% of what number?
22. \$150 is 3% of how many dollars?
23. 640 cu. ft. is 32% of how many cubic yards?
24. 360 sq. rd. is 45% of how acres?

LESSON 57

1. 2400 lb. equals $37\frac{1}{2}\%$ of how many bushels of wheat?
2. $93\frac{1}{4}$ is 32% of what number?
3. $129\frac{3}{4}$ is 56% of what number?
4. 46.5 is 45% of what number?
5. 353.3 is 49.6% of what number?
6. A grain speculator gained \$5460 in 1900, which was 75% of what he gained in 1899. How much did he gain in 1899?
7. A coal dealer sold 37,800 tons of coal in December, which was $87\frac{1}{2}\%$ of what he sold in January, and $62\frac{1}{2}\%$ of what he sold in February. How many tons did he sell in January and February respectively?
8. A coal dealer bought 80 tons of coal for \$300. After allowing 10% for waste, he retailed the remainder so as to gain 20% on his investment. Find the retail price per ton.
9. A miller owning $37\frac{1}{2}\%$ of a mill, valued at \$5000, sold his share for 20% more than its value. How much did he receive?
10. Mr. Riley failed in business and paid only 35% of his debts. How much did Mr. Koerner lose if Riley owed him \$3750?

11. What part of a quantity is 100% of it? 125% of it? 130% of it? 150% of it? 175% of it?
12. What is 120% of 400 bu. of corn?
13. What is 125% of 80 miles?
14. What is 150% of 726 sq. rd.?
15. A butcher sold a cow for \$75, and thereby gained 25%. How much did the butcher pay for it?

SUGGESTION. The butcher sold it for 100% + 25%, or 125% of its cost. Therefore \$75 = $\frac{5}{4}$, or $\frac{1}{4}$ of its cost.

16. What number increased by $\frac{1}{8}$ of itself equals 36?
17. What number increased by $12\frac{1}{2}\%$ of itself equals 45?
18. What number increased by $16\frac{2}{3}\%$ of itself equals 140?

LESSON 58

1. What number increased by 40% of itself equals 847?

<p>OPERATION $847 \div 1.40 = 605$ <i>Ans.</i></p>	<p>A number increased by 40% of itself equals 140% of the number, or 1.40 times the number. Hence the number equals $847 \div 1.40$, or 605.</p>
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2. 588 is 20% more than what number?
3. 1020 is $133\frac{1}{3}\%$ of what number?
4. What number increased by 3.5% of itself equals 414?
5. What fraction increased by 45% of itself equals $\frac{2}{3}$?
6. What number diminished by 20% of itself equals 936?

<p>OPERATION $936 \div .80 = 1170$ <i>Ans.</i></p>	<p>A number diminished by 20% of itself equals 80%, or .80 of the number. Therefore, 936 must equal .80 of the number. The number equals $936 \div .80$, or 1170.</p>
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7. 3750 is $33\frac{1}{3}\%$ less than what number?
8. 980 rd. is 51% less than how many miles?
9. 4946.05 is 22% less than what number?
10. $\frac{2}{3}$ of $\frac{5}{8}$ of $\frac{3}{4}$ of a bushel is 25% of how many bushels?
11. 81 mi. 120 rd. equal $12\frac{1}{2}\%$ less than the distance from New York to Philadelphia. What is the entire distance?
12. 140 fathoms equal $87\frac{1}{2}\%$ of how many feet?
13. 360 acres equal $22\frac{1}{2}\%$ of how many acres?
14. 4 is what part of 8? 4 is what per cent of 8?
15. 1 is what part of 5? What per cent of 5? 3 is what part of 5? What per cent of 5?
16. What per cent of 4 is 1? 2? 3?
17. What per cent of 10 is 1? 2? 3? 4? 8? 9?
18. What per cent of 40 is 10? 20? 8? 5? 2?
19. What part of 1 is $\frac{1}{2}$? What per cent of 1 is $\frac{1}{2}$?
20. What per cent of 1 is $\frac{1}{3}$? $\frac{2}{3}$? $\frac{1}{4}$? $\frac{3}{4}$? $\frac{1}{5}$? $\frac{3}{5}$? $\frac{1}{6}$? $\frac{5}{6}$?
21. What per cent of $\frac{1}{2}$ is $\frac{1}{4}$? $\frac{1}{4}$ is what per cent of $\frac{1}{2}$?
22. What part of $\frac{2}{3}$ is $\frac{1}{3}$? $\frac{1}{3}$ is what per cent of $\frac{2}{3}$?

LESSON 59

1. What number diminished by $66\frac{2}{3}\%$ of itself equals .2? $4\frac{1}{2}$? .7? 3.5? $7\frac{2}{3}$? 5.6?
2. A farmer, after selling 75% of his apples, had 9 bu. 3 pk. remaining. How many bushels had he at first?
3. If you buy a turkey for \$1.50 and sell it for \$2, what is your gain? The gain is what part of the cost? What per cent?

4. If you buy for 5¢ and sell for 6¢, the gain is what part of the cost? What per cent?

5. If you buy for 8¢ and sell for 10¢, the gain is what part of the cost? What per cent?

6. If you buy for 10¢ and sell for 8¢, the loss is what part of the cost? What per cent?

7. If you buy for $\$ \frac{1}{2}$ and sell for $\$ \frac{1}{3}$, the loss is what part of the cost? What per cent?

8. A man sold a stove for \$5 more than it cost him, thereby gaining $16\frac{2}{3}\%$. The gain is what part of the cost? Find the cost of the stove. The selling price.

9. What per cent of 450 is 90?

OPERATION We find by division that 90 is .20 of 450,
 $90 \div 450 = .20 = 20\%$ *Ans.* and .20 of anything is 20% of it.

10. What per cent of \$180 is \$60? Of \$130 is \$19.50?

11. What per cent of 4600 lb. is 575 lb.? Of 365 T. is 146 T.?

12. What per cent of 360 da. is 300 da.? Of 184 qt. is $5\frac{3}{4}$ gal.?

13. A man bought an automobile for \$900 and sold it for \$800. How much did he lose? What was the loss per cent?

14. A farmer has 480 acres of land. 48 acres are planted with corn, 96 acres with wheat, 144 acres with rye. What per cent of his land is planted with corn? With wheat? With rye?

15. The distance from New York to Philadelphia is about 96 miles. What per cent of the distance has a man gone over when he has traveled 60 mi.? 36 mi.? 84 mi.? 96 mi.?

LESSON 60

	Cost	Gain	Selling Price	Cost	Gain	Selling Price
1.	\$20	20%	?	\$3	50%	?
	\$72	$16\frac{2}{3}\%$	?	\$10	$33\frac{1}{3}\%$?
	\$7.20	$8\frac{1}{2}\%$	?	84¢	25%	?
	$\$ \frac{2}{3}$	$133\frac{1}{3}\%$	?	\$1.50	60%	?
	40¢	45%	?	\$3.60	$12\frac{1}{2}\%$?

2. If the cost is 12¢, the gain 4¢, what is the per cent of gain?

3. If the selling price is 32¢, the gain 8¢, what is the % of gain?

4. If the loss is $37\frac{1}{2}\%$, the selling price 40¢, what is the cost?

5. If the loss is 25¢, loss $16\frac{2}{3}\%$, what is the cost?

6. If the cost is 40¢, the selling price 24¢, what is the per cent of loss?

7. I bought a bicycle for \$60 and sold it for \$70. Find the gain per cent.

8. A grocer bought eggs at 15¢ a dozen and sold them at a gain of 3¢ a dozen. Find the gain per cent.

9. If a newsboy buys papers at 2¢ each and sells them at 3¢ each, what per cent does he gain?

10. If I buy for 4¢ and sell for 3¢, find the % of loss.

11. $\frac{2}{3}$ of my age + $33\frac{1}{3}\%$ of my age = 34 yr. Find my age.

12. If I buy an article for $\$ \frac{2}{3}$ and sell it for $\$ \frac{3}{4}$, what is the per cent of gain?

13. If an article is bought for $\$ \frac{2}{3}$ and sold for $37\frac{1}{2}\%$ of \$1, what is the per cent of loss?

14. Find the gain on flour bought at \$5.50 a barrel and sold at an advance of 20%. Find the selling price.

15. Flour bought at \$5.50 a barrel was sold at \$6 a barrel. Find the rate of gain.

16. A building lot was sold for \$2765, which was $16\frac{2}{3}\%$ more than it cost. How much did it cost?

17. A merchant realizes 20% profit by selling tea at 75¢ a pound. Find the cost of the tea.

18. A man bought 2 dozen turkeys and sold them at \$1.75 a pair, gaining 25% on the cost. Find the cost of the 2 dozen.

19. By selling a quantity of goods for \$7700 a merchant lost 12% of the cost. Find the cost.

LESSON 61

1. 12 sq. in. = what per cent of a square foot?

2. 432 cu. in. = what per cent of a cubic foot?

3. 2 gills = what per cent of a quart? Of a gallon?

4. A Troy pound is what per cent of an Avoirdupois pound?

5. $53\frac{1}{8}$ rod = what per cent of a mile?

6. When a man loses $12\frac{1}{2}\%$ of his money, how many sixteenths of his money are left?

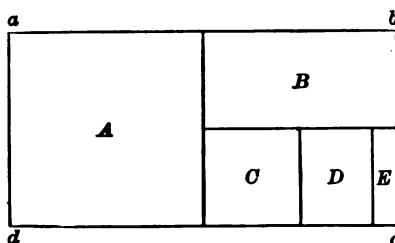
7. 2 pints = what per cent of a peck?

8. 2 in. = what per cent of a yard?

9. A man lost 5% by selling 50 spring chickens for \$28.50. How much apiece did the chickens cost?

10. Hats that cost \$36 a dozen are sold at \$2.25 apiece. Find the loss per cent.

The figure $abcd$ is a diagram of a piece of land drawn on a scale of $\frac{1}{8}$ in. to 10 rd.



11. What is the value of the entire piece at $\$37\frac{1}{2}$ an acre?

12. How many acres in A ? In B ? In C ? In D ?

13. B is what per cent of A ? A is what per cent of B ?

14. C is what per cent of B ? Of A ? A is what per cent of C ?

15. If C is sold for $\$450$, what is the gain per cent, the cost being $\$37\frac{1}{2}$ an acre?

16. What is the value of D at $\$62\frac{1}{2}$ an acre?

17. E is what per cent of D ? Of C ? Of B ?

18. The perimeter of B is what % of that of A ?

19. The sum of C and D is what per cent of B ?

20. B is what per cent of $abcd$?

21. The perimeter of E is what per cent of the perimeter of D ?

22. If E is worth $\$118.75$, how much is A worth at the same rate?

LESSON 62

1. Goods bought for $\$3750$ were sold at a gain of $\$1362\frac{1}{2}$. What per cent was gained?

2. I bought a carriage for $\$84$, which was 40% less than its value. Find its value.

3. 36% of 1600 is 144% of what number?

4. What number increased by 50% of itself equals 42.15?
5. What number increased by 34.4% of itself equals 3816.96?
6. Mt. Monadnock is 3186 ft. high. What per cent of a mile high is it?
7. A piano was sold for \$414, which was 15% more than cost. Find the cost.
8. A school which has been increased by 325% of its original number of pupils now numbers 1275 pupils. What was the original number?
9. A piece of land 80 rd. long and 20 rd. wide is what per cent of 50 acres?
10. 4260 ft. equal $41\frac{1}{3}\%$ of how many miles?
11. 75 lb. = $12\frac{1}{2}\%$ of how many hundredweight?
12. From a barrel containing 42 gal., 4.2 gal. leaked out. What per cent leaked out?
13. $3\frac{1}{5}$ quarts equal what per cent of a bushel?
14. A tailor sold a coat for \$15, which was at a gain of $33\frac{1}{3}\%$. Find the cost of the coat.
15. A merchant gained 40% by selling cloth at \$1.40 a yard. Find the cost of the cloth.
16. 5 square rods is what per cent of 5 rods square?
17. The area of one face of a cube is what per cent of the entire area of the cube?
18. What per cent of a 10-inch cube is a 5-inch cube?
19. The area of a 5-inch cube is what per cent of that of a 10-inch cube?

LESSON 63

1. What per cent of 2 cubic yards is 9 cubic feet?
2. $\frac{3}{8}$ of a cord is what per cent of 96 cubic feet?
3. 8 is what per cent of 10? 10 is what per cent of 8?
4. 8 is what per cent of $10 + 8$? 10 is what per cent of $8 + 10$?
5. $12\frac{1}{2}\%$ is what per cent of $37\frac{1}{2}\%$? $62\frac{1}{2}\%$? $87\frac{1}{2}\%$?
6. What per cent of $.87\frac{1}{2}$ is $\frac{1}{8}$? $\frac{3}{8}$? $\frac{5}{8}$? $\frac{7}{8}$?
7. A gardener planted 260 celery plants and 39 died. What per cent died?
8. What is $8\frac{1}{3}\%$ of 96 yd.? \$1.44? What is $112\frac{1}{2}\%$ of \$8.40?
9. What is 60% of 45 in.? 4.5 in.? .45 in.?
10. Willard Johnson had \$73.40 in a dime savings bank. He drew out \$25.69 to pay for a watch. What per cent did he draw out?
11. Find the gain per cent if goods are bought at $87\frac{1}{2}\%$ and sold at \$1.12 $\frac{1}{2}$.
12. Draw a trapezoid, making one of the parallel sides 4 in. long, the other 6 in. long, and the altitude 2 in. Find the area of the trapezoid.
13. Draw another trapezoid having dimensions one half those in the preceding example. Find its area.
14. What is the relation of the answer of the 13th to that of the 12th example?
15. Mr. James bought 3 loads of coal weighing 2350 lb., 2432 lb., and 2318 lb. respectively, paying \$2.40 a ton. He sold it all for \$10.65. What was the gain per cent?

INTEREST

LESSON 64

1. Define interest; principal; rate; amount.
2. What is the interest of \$300 for 1 yr. at 5%?

MODEL. At 5%, $\frac{1}{20}$, or $\frac{1}{20}$ of the principal equals the interest for 1 yr. $\frac{1}{20}$ of \$300 = \$15 *Ans.*

3. What is the interest of \$200 for 1 yr. at 4%? 5%? 6%? 7%?

4. What is the interest of \$200, at 4% for 1 yr.? 3 yr.? 3 yr. 6 mo.? 3 yr. 9 mo.?

5. At 6%, what part of the principal equals the interest for 1 yr.? 2 yr.? 3 yr.?

6. At 7%, what is the interest of \$300 for 1 yr.? 2 yr.? 2 yr. 8 mo.?

7. If \$24 is the interest of a given sum for 1 yr., what is the interest for 1 mo.? 2 mo.? $\frac{1}{2}$ yr.? $\frac{3}{4}$ yr.?

8. At $4\frac{1}{2}\%$, what is the interest of \$60 for 1 yr.? 2 yr.? 9 mo.?

9. The interest of a given sum of money for 5 mo. is \$30. What is the interest for 7 mo.? 8 mo. 15 da.?

10. What is the interest of \$960 for 2 yr. at 5%?

MODEL. $\$960 \times .05 = \48.00 , interest for 1 yr.
 $\$48 \times 2 = \96 , interest for 2 yr. *Ans.*

11. Find the interest of \$720 for 3 yr. 8 mo. at 5%.

12. Find the interest of \$2000 for 1 yr. 3 mo. 12 da. at 6%.

$$\begin{array}{rcl}
 \text{MODEL.} & 1 \text{ yr.} & = 12 \text{ mo.} \\
 & 3 \text{ mo.} & = 3 \text{ mo.} \\
 & 12 \text{ da.} & = .4 \text{ mo.} \\
 \hline
 & 1 \text{ yr. 3 mo. 12 da.} & = 15.4 \text{ mo.} \\
 & \$2000.06 = \$120 & = \text{int. for 1 yr.} \\
 & \$120 \div 12 = \$10 & = \text{int. for 1 mo.} \\
 & \$10 \times 15.4 = \$154 & = \text{int. for 15.4 mo. } \textit{Ans.}
 \end{array}$$

13. Find the interest of \$1000 for 4 yr. 4 mo. 15 da. at 3%.
14. Find the interest of \$1500 for 3 yr. 11 mo. 18 da. at 4%.
15. Find the interest of \$940 for 2 yr. 2 mo. 6 da. at $4\frac{1}{2}\%$.
16. Find the interest of \$720 for 2 yr. 6 mo. 24 da. at $3\frac{1}{2}\%$.
17. Find the interest of \$725 for 3 yr. 1 mo. 9 da. at 5%.

LESSON 65

The **Amount** is the sum of the principal and interest.

1. Find the amount of \$860 for 2 yr. 4 mo. 24 da. at 6%.

$$\begin{array}{l}
 \text{MODEL. Time} = 28.8 \text{ mo.} \\
 (\$860 \times .06) \div 12 = \$4.30 = \text{int. for 1 mo.} \\
 \$4.30 \times 28.8 = \$123.84 = \text{int. for 28.8 mo.} \\
 \$860 + \$123.84 = \$983.84 = \text{amt. } \textit{Ans.}
 \end{array}$$

2. Find the amount of \$580 for 3 yr. 6 mo. 6 da. at 5%.
3. Find the amount of \$1150 for 1 yr. 8 mo. 3 da. at 4%.
4. Find the amount of \$1230 for 2 yr. 2 mo. 27 da. at 5%.

5. Find the amount of \$1125 for 3 yr. 3 mo. 15 da. at 8%.

6. Find the interest of \$500 for 90 days at 6%.

SUGGESTION. 90 days = $\frac{90}{360}$ or $\frac{1}{4}$ of a year.
 $\$500 \times .06 \times \frac{1}{4} = ?$

7. Find the interest of \$1800 for 90 da. at 6%.

8. Find the interest of \$900 for 65 da. at 3%.

9. Find the interest of \$972 for 10 mo. 10 da. at 6%.

10. Find the interest of \$540 for 2 mo. 17 da. at 6%.

MODEL. 2 mo. 17 da. = $2\frac{17}{12}$ mo.

$(\$540 \times .06) \div 12 = \$2.70 = \text{int. for 1 mo.}$

$\$2.70 \times 2\frac{17}{12} = \6.93 Ans.

Find the interest at 6% of:

PRINCIPAL	TIME
11. \$520	1 yr. 2 mo. 9 da.
12. \$650	2 yr. 4 mo.
13. \$540	9 mo. 27 da.
14. \$680	3 yr. 24 da.
15. \$790	70 da.
16. \$920	2 yr. 7 mo. 21 da.
17. \$760	1 yr. 2 mo. 18 da.
18. \$365	3 yr. 15 da.
19. \$485	2 yr. 2 mo. 16 da.
20. \$565	2 yr. 1 mo. 25 da.

LESSON 66

When a man borrows money of another it is customary for the borrower to give a note (a promise to pay) as evidence that he has borrowed the money. The borrower is called the **Maker** of the note, and the lender the **Payee**.

Following is a model of an ordinary *promissory note* :

\$ 200.

HARRISBURG, PA., Aug. 25, 1900.

Two years after date, for value received, I promise to pay Harton Jules, or order, Two Hundred Dollars, with interest at 5%.

SAMUEL RUDOLPH.

1. Who is the *maker* of this note? The *payee*?
2. How much money does Rudolph agree to pay Jules? The sum of money loaned is called the **Face** of the note. It is sometimes called **Principal**.
3. What rate of interest does Rudolph promise to pay?
4. When will this note be *due*, or mature? Name the year, month, and day of the month.
5. What is the interest of \$200 for 1 yr. at 5%? For 2 yr.?
6. How much money must Rudolph pay Jules when this note is due?
7. Write a promissory note, using the following data: Date, Aug. 30, 1900. Time, 6 mo. Maker, John Morrison. Payee, Willis Bates. Face, \$150. Rate of interest, 6%.
8. When will this note be due?
9. What is the interest of \$150 for 6 mo. at 6%?
10. How much money must Morrison pay Bates when this note matures?
11. Find the amount of a note for \$340, dated Sept. 3, 1900, and paid Dec. 3, 1900. Interest 6%.
12. Find the amount of a note for \$600, dated Oct. 7, 1900, and paid March 7, 1901. Interest 5%.

LESSON 67

\$500.

SCRANTON, PA., Jan. 20, 1901.

Six months after date, for value received, I promise to pay C. B. Doty, or order, Five Hundred Dollars, with interest at 5%.

ALEXANDER PATTERSON.

1. This note was paid Sept. 2, 1900. Find amount due.

MODEL

	yr.	mo.	da.
When paid, 1901		9	2
When given, 1901		1	20
Time,		7	12 = 7.4 mo.

$$(\$500 \times .05) \div 12 = \$2.08\frac{1}{3} = \text{int. for 1 mo.}$$

$$\$2.08\frac{1}{3} \times 7.4 = \$15.416\frac{2}{3} = \text{int. for 7.4 mo.}$$

$$\$500 + \$15.416\frac{2}{3} = \$515.416\frac{2}{3}, \text{ amt. due Ans.}$$

\$350.

WASHINGTON, D.C., Oct. 4, 1900.

One year after date, for value received, I promise to pay James Atherholt, or order, Three Hundred Fifty Dollars, with interest at 4%.

HERMON PHILLIPS.

2. Who is the maker of the above note? Who is the payee?

3. What is the face of the note? The rate of interest?

4. When will the note be due?

5. If Phillips pays the note Dec. 25, 1901, how much must he pay Atherholt?

Write notes in accordance with the following data, supplying the place and date of writing :

	Face	Time	Maker	Payee	Rate
6.	\$375	6 mo.	H. Jordan	D. H. Frantz	5%.
7.	\$640	3 mo.	F. Santer	Robert Shay	4½%.
8.	\$720	8 mo.	C. Gates	Chas. Price	5½%.
9.	\$840	9 mo.	J. Smith	Wayne James	6%.
10.	\$725	4 mo.	L. Stearns	John Lamb	3½%.

Find the amount of each of the above notes when due.

11. William Creter owes Charles Stout \$340 to be paid in 6 mo., with interest at 5½%. Find the amount due at maturity.

12. \$800.

ALBANY, N.Y., March 25, 1901.

Six months after date, for value received, I promise to pay M. Murray, or order, Eight Hundred Dollars, with interest at 5%.

THOMAS KAST.

Sept. 25, 1901, Mr. Kast paid the interest due on the note, and \$200 of the principal. 3 months later Mr. Kast paid the note in full with interest. How much did he pay?

MISCELLANEOUS WORK

LESSON 68

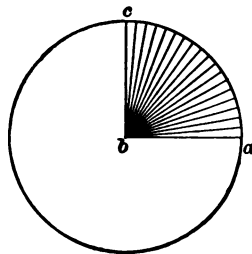
1. A wheelbarrow was bought for \$1.50 and sold for \$3. What per cent was gained?
2. There are 180 acres in Roy Green's farm, and $\frac{3}{4}$ of the number of acres in his farm equals 20% more than the number of acres in his brother's farm. What part of Roy's farm equals his brother's farm?
3. 16 rd. equal what per cent of 24 rd.? 24 rd. equal what per cent of 16 rd.?
4. A man picked 24 quarts of blackberries. He sold $33\frac{1}{3}\%$ of them to his neighbor, $12\frac{1}{2}\%$ of the remainder to his grocer, and what still remained his wife canned. How many pint cans did she need if there was a loss of $\frac{1}{4}$ in canning?
5. A farmer sold 195 bu. of corn, which was equal to 65% of what he had left. How many bushels had he at first?
6. $16\frac{2}{3}\%$ of a yard equals what per cent of a foot?
7. If $.7\frac{1}{2}$ tons of hay is worth \$6.33, how much must be paid for $1\frac{3}{4}$ tons?
8. I bought a dozen boxes of matches, each box containing 500 matches, for \$ $\frac{1}{2}$. What fraction of a cent was paid for each match?

9. If $37\frac{1}{2}\%$ of a barrel of flour costs \$2.10, how many barrels will cost \$61.60?
10. What per cent of 12 yd. 2 ft. 6 in. is 4 yd. 10 in.?
11. If $\frac{4}{5}$ of the value of a house is \$2350, what is $87\frac{1}{2}\%$ of its value?
12. If 80 yard of carpet cost \$64, find the cost of $32\frac{3}{4}$ yd.
13. If 1.25 acres of land are worth \$87.50, what is the value of 32.3 acres?
14. Find the interest of \$350 for 1 yr. 8 mo. 12 da. at 6%.
15. Multiply $288\frac{3}{4}$ by $28\frac{5}{8}$.
16. Find the number of which 302 is $\frac{1}{4}\%$. Of which \$91.30 is $7\frac{1}{3}\%$.
17. A 2-foot cube is what per cent of a cubic yard?

LESSON 69

1. If $\frac{5}{11}$ of an acre of land is worth \$45.25, what is the value of $16\frac{1}{5}$ acres?
2. A laborer worked $\frac{3}{4}$ of a day on Monday; $7\frac{1}{2}$ hr. on Tuesday; $6\frac{3}{4}$ hr. on Wednesday; 5 hr. on Thursday; $\frac{2}{3}$ of a day on Friday; and $\frac{1}{2}$ of a day on Saturday. How much did he earn during the week if he received \$1.25 a day, 8 hr. constituting a day?
3. What per cent of 2000 lb. is a barrel of flour?
4. \$11 $\frac{1}{5}$ is $44\frac{4}{5}\%$ of how many dollars?
5. The difference between $12\frac{1}{2}\%$ and $16\frac{2}{3}\%$ of a number is $87\frac{1}{2}$. What is the number?
6. 96 is $14\frac{2}{7}\%$ less than what number?

7. $5\frac{1}{2}$ yd. is what per cent of 3 rd. ?
8. $5\frac{1}{2}$ ft. is what per cent of a rod ?
9. If $\frac{3}{4}$ is multiplied by $\frac{3}{4}$, will the answer be greater or less than $\frac{3}{4}$? How many per cent ?
10. If 4 books cost \$1.68, how much will 25 cost ?
11. What is the relation of $\frac{2}{3}$ of a dozen to 4 ?
12. If 12.5 yd. of cloth cost \$19 $\frac{1}{2}$, how much will 25 yd. cost ?
13. If it takes 48 yd. of carpet $\frac{3}{4}$ yd. wide to cover a floor, how many yards $\frac{2}{3}$ yd. wide will be needed to cover the same floor ?
14. What is a sector ?
15. A sector of 90° is what per cent of the circle ?
16. The sector abc is what per cent of the circle ?
17. The arc ac is what per cent of the circumference of the circle ?
18. Find the area of the sector abc , the radius being 4 in. (First find the circumference.)
19. Find the area of the circle.
20. The area of the sector is what per cent of the area of the entire circle ?
21. A sector of 45° is what per cent of the circle ?
22. A sector of 60° is what per cent of the circle ?



LESSON 70

1. A piece of cloth containing 30 yd. cost \$5. For how much a yard must it be sold to gain $12\frac{1}{2}\%$?

STANDARD SCHOOL GEOGRAPHIES

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Elementary . \$0.55
Higher . . . 1.25

Barnes's
Elementary . .55
Complete . . 1.25

Eclectic
Elementary . .55
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Harper's
Introductory . .48
School . . . 1.08

Swinton's
Introductory . .55
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In text-books, as in nature, the doctrine of the "survival of the fittest" prevails. In no other class of text-books has there been more change, more experiments, and withal more improvement than in School Geographies. But while many Geographies have been offered and tried, only a few have passed the crucial test of actual use in schools for a sufficient length of time to determine the true measure of their usefulness. Of these the five named herewith are recognized as the Standard Series of Geographies by the teaching profession and school authorities of the whole country. Some of the features which distinguish these Geographies and make them so popular and satisfactory are the following:

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16. How much coal will \$16.80 buy if $87\frac{1}{2}\%$ of a ton is worth \$2.10?

17. If $82\frac{3}{4}$ yd. of cloth cost \$47.12, how much will 47.1 yd. cost?

18. 48 men can do a piece of work in $10\frac{1}{2}$ days. How many men can do it in 21 days?

LESSON 71

1. A owns $\frac{3}{8}$ of a piece of land, and B owns the remainder. If B's share is $34\frac{1}{8}$ acres less than A's, how many acres does each own?

2. $\frac{5}{8}$ of 60 is $66\frac{2}{3}\%$ of what number?

3. 60% of 80 is what per cent of .5 of 120?

4. If a certain number is increased by 60% of itself, the sum will equal 240. What is the number?

5. Find the interest of \$250 for 3 mo. at 6%.

6. A druggist bought quinine at 32¢ an ounce avoirdupois weight, and retailed it at the rate of 30 grains for 10¢. Find the gain per cent.

7. What number diminished by $\frac{3}{8}$ of itself equals $.3\frac{1}{8}$?

8. A miller bought 720 bu. of wheat at 68¢ a bushel. He sold 288 bu. at $87\frac{1}{2}$ ¢ a bushel, and made the remainder into flour which he sold at \$4.50 a barrel. Did he gain or lose by the transaction, and how much, allowing $4\frac{1}{2}$ bu. to make a barrel of flour?

9. A boy spent $33\frac{1}{3}\%$ of his money for a bicycle, \$25 for a suit of clothes, and then had \$23. How much money had he at first?

10. If a man's age is diminished by 15% and 7 yr., the remainder will equal 27 yr. What is his age?

11. A man sold a coupé for \$82.50 and gained 25%. Find the cost. Find the gain.

12. A merchant bought 160 yd. of calico at $12\frac{1}{2}$ ¢ a yard and sold it at a reduction of 2.5%. Find the entire loss.

13. I made 24% by selling 25 barrels of sweet potatoes for \$69.75. How much did they cost me a barrel?

14. \$.02 $\frac{1}{2}$ is 8% of how many cents?

15. If .75 of 6 bushels of wheat cost \$4.5, how much will 80% of 2 bu. cost?

LESSON 72

1. If 42 $\frac{3}{4}$ % of my neighbor's farm equals 28 $\frac{1}{2}$ acres, how many acres are there in his farm?

2. If a tank can be filled by a pipe in 11 hr., what part can be filled in 1 hr.? In $\frac{1}{2}$ hr.? In 3 $\frac{1}{2}$ hr.?

3. A man having \$2550 spent \$420 for an automobile, \$224 for a horse, and \$172 for a carriage. What per cent of his money remained?

4. I sold a cow for \$32.64 and thereby lost 4%. Find the cost of the cow.

5. By selling goods for \$84 a profit of 16 $\frac{2}{3}$ % will be realized. What is the cost of the goods?

6. \$220 is 137 $\frac{1}{2}$ % of the cost of an acre of land. Find the cost.

7. If $\frac{5}{8}$ of a melon is worth 2 $\frac{1}{2}$ ¢, what is the value of 1 melon? Of $\frac{3}{8}$ of a melon? Of $\frac{3}{4}$ of a melon?

8. If $\frac{2}{5}$ of 6 yd. of cloth cost \$2 $\frac{2}{5}$, how much will $\frac{3}{5}$ of 7 yd. cost?

9. A man sold a horse for $1\frac{3}{4}$ times what it cost him and by so doing gained \$36. How much did the horse cost him?

10. A merchant purchased 320 bbl. of flour at \$4.75 a barrel. For how much must he sell the whole of it to gain 35%?

11. A merchant sold a quantity of goods for $1\frac{3}{8}$ of their cost and by so doing lost \$25. Find the cost of the goods.

12. I bought $3\frac{2}{3}$ boxes of goods at \$6 $\frac{4}{11}$ a box. How many turkeys, at \$2 each, will pay for the goods?

13. If $5\frac{2}{5}$ yd. of flannel cost \$5 $\frac{4}{10}$, how much will 4 yd. cost?

14. A woman sold $\frac{5}{9}$ of her eggs to one man and $\frac{1}{3}$ of them to another, and then had 11 remaining. How many had she at first?

15. Two men started from the same place and traveled in the same direction, one at the rate of 46 mi. in 5 hr., and the other $1\frac{1}{10}$ mi. in $\frac{1}{4}$ of an hour. How far apart will they be in 3 hours?

16. If $\frac{3}{5}$ yd. cost \$2 $\frac{1}{4}$, how much will $\frac{3}{4}$ yd. cost?

17. Find the cost of 20% of 75 oranges, at the rate of $\frac{1}{4}$ doz. for 5¢.

18. $66\frac{2}{3}\%$ of 24 is 160% of what number?

19. A flour dealer sold $33\frac{1}{3}\%$ of 2640 bbl. of flour to one man, $12\frac{1}{2}\%$ of the remainder to another. He sold what still remained for \$4527.60. How much was that a barrel?

20. From a piece of silk there were cut 5 pieces, each containing $3\frac{2}{7}$ yd., and there remained $2\frac{6}{7}$ yd. How many yards did the whole piece contain?

PRACTICAL MENSURATION

LESSON 73

Government lands are divided into **Townships**, 36 miles square, by parallels and meridians. Townships are divided into **Sections**, one mile square, 640 acres. Each section is subdivided into *half-sections*, 320 acres; *quarter-sections*, 160 acres; *half-quarter-sections*, 80 acres; and *quarter-quarter-sections*, 40 acres.

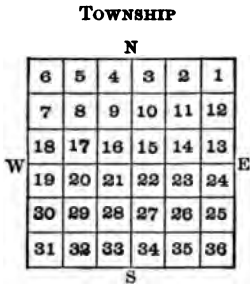


FIG. 1

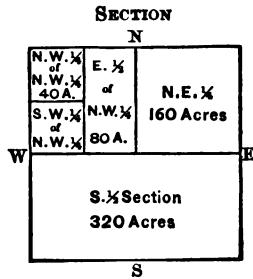


FIG. 2

Figure 1 shows the division of a township into sections and the way they are numbered, beginning at the N.E. corner.

Figure 2 shows, on an enlarged scale, how sections are divided and named.

1. How many acres are there in a section? How many sections in a township?

3. How many acres are there in a township?
4. How many acres are there in a half-section?
5. One section is what part of a township?
6. What part of a township is a half-section?
7. What is the perimeter of a township? Of a section?
8. How many acres are there in a quarter-section?
9. What is the perimeter of a quarter-section?
10. The perimeter of a section is what per cent of the perimeter of a township?
11. The perimeter of a quarter-section is what per cent of the perimeter of a half-section?
12. How many acres are there in a half-quarter-section?
13. How many acres are there in a quarter-quarter-section?
14. What is the length, in rods, of a half-section? In chains? State the width, in rods, of a half-section. In chains.
15. A quarter-quarter-section is what part of a whole section? What per cent of a whole section? What per cent of a half-section?
16. How many acres are there in a tract of land 1 mi. long and 160 rd. wide?
17. How many acres are there in a piece of land 80 ch. long and 40 ch. wide?
18. Find the number of acres in a piece of land 10 ch. square.

LESSON 74

Plastering Laths are usually 4 ft. long, $1\frac{1}{2}$ in. wide, and $\frac{3}{8}$ in. thick. They are generally put up in bundles of 100 laths each. After allowing for waste, it is estimated that a bundle will cover 6 sq. yd.

Plastering is estimated by the square yard. In some localities it is not customary to make any deduction for windows, doors, etc., while in others as much as one half is sometimes allowed for openings. In estimating materials, allowance is made for openings.

1. How many bundles of laths will cover a ceiling 36 ft. long and 18 ft. wide?

<p style="text-align: center;">OPERATION</p> <p>$(36 \times 18) \div 9 = 72$, sq. yd. in ceiling.</p> <p>$72 \div 6 = 12$, no. bundles <i>Ans.</i></p>	<p>There are 72 sq. yd. in the ceiling. Since <i>one bundle</i> will cover 6 sq. yd. there will be needed as many bundles as 6 is contained times in 72, or 12.</p>
--	---

2. How many bundles of laths will be required to cover the walls and ceiling of a room 45 ft. long, 27 ft. wide, and 18 ft. high, allowing 200 square feet for windows and doors?

3. How many bundles of laths will be needed for a room 63 ft. long, 45 ft. wide, 18 ft. high, deducting 4 doors 12 ft. by 6 ft. and 8 windows 10 ft. by 4 ft.?

4. Find the cost of lathing and plastering both sides of a partition 36 ft. long and 18 ft. high, if the laths cost 25¢ a bundle, and the plastering 18¢ a square yard.

5. In Ex. 3, find the cost of lathing and plastering, if the laths cost 22¢ a bundle, and the plastering 18¢ a square yard, making no allowance for windows and doors in plastering.

LESSON 75

Painting and Kalsomining are usually estimated by the square foot or square yard.

The wall paper commonly used is 18 in. wide, and is put up in single rolls 24 ft. long, or in double rolls 48 ft.

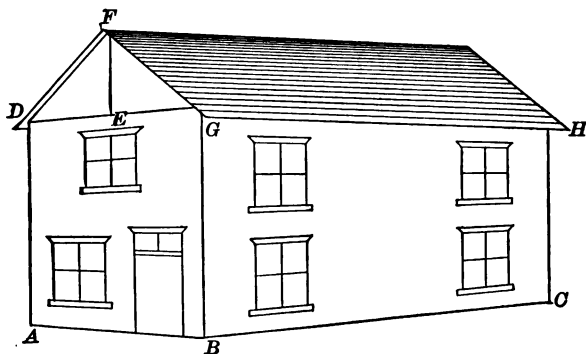
long. The exact cost of the paper required for a room can be ascertained only by counting the number of rolls actually used, reckoning any part of a roll used as a whole one, after the work has been completed.

In making estimates, paper hangers ascertain the approximate number of rolls that will be required by dividing the exact number of square feet to be covered by the number of square feet in a double roll.

1. How much will it cost to whiten the ceiling and walls of a schoolroom 24 ft. wide, 36 ft. long, and 14 ft. high, at 5¢ a square yard, deducting 20 sq. yd. for openings?

2. How many double rolls of paper would it take to cover the ceiling and walls of the room described in Ex. 1? No allowance for openings.

SUGGESTION. Divide the number of square feet to be covered by the number of square feet in a double roll.



3. This drawing represents a frame house. $AB = 18$ ft.; $BC = 36$ ft.; $AD = 24$ ft.; $EF = 9$ ft.; $GH = 38$ ft.; $FG = 14$ ft.

4. At 3¢ a square foot, how much will it cost to paint the roof?
5. How much will it cost to paint the two gables at $2\frac{1}{2}$ ¢ a square foot?
6. How much will it cost to paint the two sides and two ends (not including the gables) at $12\frac{1}{2}$ ¢ a square yard, making no allowance for windows and doors?

LESSON 76

1. How many double rolls of paper will be needed to cover the ceiling and walls of a room 16 ft. by 12 ft. and 9 ft. high, deducting 3 windows each 3 ft. by 6 ft., and 1 door $2\frac{1}{2}$ ft. by $6\frac{2}{3}$ ft.?
2. At 22¢ a square yard, how much will it cost to plaster the ceiling and walls of the room described in the preceding example? No allowance for openings.
3. Find the entire cost of papering the following rooms, at 60¢ a double roll, bordering 10¢ a yard :
 - 18 ft. by 16 ft. and 9 ft. high.
 - 12 ft. 8 in. by 15 ft. and 9 ft. high.
 - 14 ft. 6 in. by 16 ft. and 9 ft. high.
 - 13 ft. by 15 ft. and 9 ft. high.

Make no allowance for bordering.

4. Find the cost of the laths, at 25¢ a bundle, required to cover the ceiling and walls of a room 12 ft. by 16 ft., and 9 ft. high, deducting 2 windows 8 ft. by 4 ft. and 1 door 6 ft. by 3 ft.

Carpeting is sold by the yard. Brussels carpet is 27 in. wide, ingrain 36 in. In order to ascertain the number of yards needed for a given room, first decide which way

the strips shall run, lengthwise or across the room, then, allowing for waste in matching, multiply the length of one strip in yards by the number of strips needed, and the product will be the number of yards needed.

5. How many yards of Brussels carpet will be required to cover a floor 27 ft. long and 18 ft. wide, the strips to run lengthwise? Make a diagram.

6. Find the number of yards of ingrain carpet required to cover a floor 15 ft. wide, 17 ft. 6 in. long, the strips to run lengthwise.

7. How are painting and kalsomining usually estimated?

8. What is the width of the wall paper commonly used? How is it put up?

9. What are the dimensions of plastering laths? How are they generally put up? A bundle will cover how much surface?

10. How many yards of ingrain carpet will be needed for a room 14 ft. wide and 18 ft. long, the strips to run lengthwise? How many strips will be needed? How many inches must be turned under?

LESSON 77

Wood cut 4 ft. long is called **Cord Wood**. A pile of such wood, 4 ft. high and 8 ft. long (128 cu. ft.), is called a *cord*.

1. How many cords of wood are in a pile 60 ft. long, 8 ft. high, and 4 ft. wide?

2. How many cords of wood can be piled into a shed 32 ft. long, 16 ft. wide, and 20 ft. high?

3. How high must wood, 4 ft. long, be piled upon a sled 12 ft. long to make 2 cords?

4. A shed 32 ft. long, 24 ft. wide, and 14 ft. high is filled with tan bark. What is the value of the bark at \$8.25 per cord?

A Board Foot is a square foot one inch thick.

5. A cubic foot contains how many board feet?

6. To change cubic feet to board feet by what number do we multiply?

7. To reduce board feet to cubic feet by what number do we divide?

8. How many board feet are there in 2 cubic feet?

9. How many board feet are there in a board 12 inches wide, 10 ft. long, and 1 inch thick?

Boards less than 1 in. thick are considered the same in commerce as boards 1 in. thick; that is, a board $\frac{3}{4}$ in. or $\frac{1}{2}$ in. thick, 1 ft. wide, and 12 ft. long is regarded as containing 12 board feet. But a board $1\frac{1}{4}$ in. or $1\frac{1}{2}$ in. thick contains $1\frac{1}{4}$ times or $1\frac{1}{2}$ times as many board feet as a board 1 in. thick. Thus, a board $1\frac{1}{4}$ in. thick, 1 foot wide, 12 ft. long, contains $1\frac{1}{4} \times 1 \times 12$, or 15 board feet.

10. Find the number of board feet in a board 15 ft. long and 16 in. wide.

OPERATION

$$16 \div 12 = 1\frac{1}{3} \text{ ft.} = \text{width.}$$

$$1\frac{1}{3} \times 15 = 20, \text{ board feet } \textit{Ans.}$$

We change the width, 16 in., to its equivalent, $1\frac{1}{3}$ ft.; then multiply the length by the width, and obtain 20, the number of board feet in the board.

11. Find the number of board feet in a board 16 ft. long and 15 in. wide.

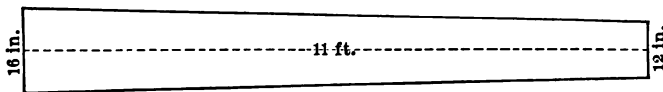
12. Find the number of board feet in a board 15 ft. long, 16 in. wide, and $1\frac{3}{4}$ in. thick.

13. How many board feet are there in 25 planks each 18 ft. long, 16 in. wide, and $1\frac{1}{2}$ in. thick?

LESSON 78

When a board tapers regularly, we find its average width by taking half the sum of the two ends.

The following drawing represents a board 11 ft. long, 16 in. wide at one end, 12 in. at the other, and 1 in. thick.



OPERATION

$(16 \text{ in.} + 12 \text{ in.}) \div 2 = 14 \text{ in.} = 1\frac{1}{4} \text{ ft.}$, average width of board.

$11 \times 1\frac{1}{4} = 12\frac{3}{4}$, board feet.

1. The above drawing is what plane figure?
2. Give rule for finding area of trapezoid.
3. Find the number of board feet in a board 20 ft. long, 12 in. wide at one end, 8 in. at the other, and 1 in. thick.
4. How many board feet in a board 16 ft. long, 14 in. wide at one end, 12 in. at the other, and $1\frac{1}{2}$ in. thick?

The term **Lumber**, as used here, includes all kinds of hewed or sawed materials.

5. The following drawing represents a joist 8 in. wide, 2 in. thick, and 8 ft. long. Find the number of board feet in it.



OPERATION

$(8 \times 2) \div 12 = 1\frac{1}{3}$.

$8 \times 1\frac{1}{3} = 10\frac{2}{3}$, board feet *Ans.*

A joist 2 in. thick and 8 in. wide is equal to a board 16 in., or $1\frac{1}{3}$ ft., wide.

6. Find the number of board feet in a joist 8 in. by 3 in. and 12 ft. long.
7. How many board feet are there in 33 joists 8 in. by $2\frac{1}{2}$ in. and 20 ft. long?
8. How many board feet are there in 36 rafters 6 in. by 2 in. and 18 ft. long?
9. Find the number of board feet in a girder 10 in. by 16 in. and 32 ft. long.
10. Find the number of board feet in 4 posts 8 in. square and 24 ft. long.
11. How many board feet are there in 36 studding, each 2 in. by 4 in. and 18 ft. long?
12. How many board feet are there in 2 girders 40 ft. long, 12 in. wide, and 10 in. thick?

LESSON 79

Shingling and **Slatting** are usually estimated by the *square* (100 sq. ft.); **Tinning** by the square foot.

The most common lengths of shingles are 16 in. and 18 in. They are considered to average 4 in. in width, and are generally laid 4 in., $4\frac{1}{2}$ in., or 5 in. to the weather. For convenience in handling, and in order to meet the demands of trade, shingles are put up in bunches of 250 each. As a rule, dealers do not sell less than one bunch. In making estimates, carpenters ordinarily reckon 1000 shingles to the square.

1. It took 25 bunches of shingles to lay the roof of a shed. How many thousands were used?
2. Find the number of bunches of shingles that will be required to lay a double roof 32 ft. long, the rafters being 14 ft. long.

3. Find the cost of the shingles required to cover a double roof 48 ft. long, the length of the rafters being 22 ft., at \$1.25 per bunch.

4. What will be the cost of slating a roof 50 ft. long, at \$12.75 a square, if each side of the roof is 20 ft. wide?

5. Find the cost of tinning a porch roof 32 ft. long and 7 ft. 9 in. wide, at 7¢ a square foot.

Earth, Sand, and Gravel are generally estimated by the cubic yard or load.

A *perch* of stone is $16\frac{1}{2}$ ft. long, $1\frac{1}{2}$ ft. thick, and 1 ft. high; it contains $16\frac{1}{2} \times 1\frac{1}{2} \times 1$, or $24\frac{3}{4}$ cu. ft. A perch of stone will make about 21 cu. ft. of wall.

Brickwork is ordinarily estimated by the thousand bricks. The size and style of bricks vary greatly. The most common size is $8\frac{1}{2}$ in. long, 4 in. wide, and $2\frac{1}{2}$ in. thick. In making estimates it will be sufficiently accurate to reckon 21 bricks to the cubic foot.

In estimating materials, deductions are made for corners, windows, doors, etc., but in estimating labor no deductions are made unless agreed upon by contract.

LESSON 80

1. How many perches of masonry are there in a stone wall 42 ft. long, 6 ft. high, $1\frac{1}{2}$ ft. thick?

2. Find the cost of digging a cellar 32 ft. long, 22 ft. wide, and 6 ft. deep, at 36¢ a cubic yard.

3. How much will it cost to build a stone wall 4 rd. long, 4 ft. high, and 2 ft. thick, at \$6.75 a perch?

4. How many perches of masonry are there in the foundation walls of a house 40 ft. long and 28 ft. wide, if

the walls are $2\frac{1}{2}$ ft. thick and 6 ft. high? Use outside measurements.

5. How many bricks will be required to build a wall 30 ft. long and 6 ft. high, the wall being 2 bricks, or 9 in., thick? Allow 21 bricks to make 1 cu. ft. of wall.

6. How many bricks are required for a partition wall 36 ft. long, 20 ft. high, and 9 in. thick?

7. Find how many bricks are required to build the outside walls of a house 32 ft. long, 24 ft. wide, 18 ft. high, and 18 in. thick, deducting 450 cu. ft. for openings. Count corners but once.

8. How much will it cost to excavate a street 1000 ft. long, 50 ft. wide, to the depth of 18 in., at 35¢ a load?

9. How much will it cost to dig a well 6 ft. in diameter and 20 ft. deep, at 45¢ a cubic yard?

10. Find the cost of digging a cistern 10 ft. in diameter and 6 ft. deep, at 36¢ a cubic yard.

11. How many perches of masonry are there in a wall 100 ft. long, 8 ft. high, and 18 in. thick?

12. How many bricks are required for constructing a wall 60 ft. long, 10 ft. high, and 26 in. thick?

13. How many perches of masonry are there in a wall 48 ft. long, 8 ft. high, and 18 in. thick, allowing 144 cu. ft. for openings?

LESSON 81

Since there are 2150.42 cu. in. in a bushel, and 1728 cu. in. in a cubic foot, a bushel is equal to $2150.42 \div 1728$, or $1\frac{1}{4}$ cu. ft., nearly. Hence, for practical purposes, it is sufficiently accurate to say that $\frac{4}{5}$ of the number of bushels will represent the number of cubic feet, and $\frac{5}{4}$ of the number of cubic feet will equal the number of bushels.

1. Find the *approximate* number of bushels contained in a bin 12 ft. long, 6 ft. wide, and $4\frac{1}{2}$ ft. deep.

MODEL. $12 \times 6 \times 4\frac{1}{2} = 324$ cu. ft. in bin.

$\frac{1}{3} \times 324 = 259.2$, approximate number bushels *Ans.*

2. Find the approximate number of bushels in a bin $18\frac{1}{2}$ ft. long, 9 ft. wide, and $8\frac{1}{2}$ ft. deep.

3. Find the approximate number of bushels that a wagon box will hold, if it is 11 ft. long, 3 ft. wide, and 2 ft. deep.

4. Find the *exact* number of bushels in a bin 8 ft. long, 6 ft. wide, and 4 ft. deep.

MODEL. $8 \times 6 \times 4 \times 1728 = 331,776$ cu. in. in bin.

$331,776 \div 2150.42 = 154.28 +$, exact number bushels *Ans.*

5. Find the exact number of bushels contained in a bin 15 ft. long, 10 ft. wide, and 6 ft. deep.

6. Find the exact number of bushels contained in a bin 20 ft. long, $8\frac{1}{2}$ ft. wide, and 6 ft. deep.

Find the approximate number of bushels also.

7. Find the *exact* and *approximate* number of cubic feet in a bin that will hold 200 bu.

MODEL.

$(2150.42 \times 200) \div 1728 = 248.89 +$, exact number cubic feet.

$200 \times 1\frac{1}{4} = 250$, approximate number cubic feet *Ans.*

LESSON 82

1. Find the exact number of cubic feet in a bin holding 250 bu. Find the approximate number of cubic feet.

2. Find the exact number of cubic feet in a rectangular box that will contain $64\frac{1}{2}$ bu. Find the approximate number of cubic feet.

3. What is the difference between the exact and approximate number of cubic feet in the space occupied by 450 bu. ?

4. Name five articles that are sold by stricken, or even measure. Name five articles that are sold by heaped measure.

The space occupied by a heaped bushel is 2747.7 cu. in., or 1.59+ cu. ft. ($2747.7 \div 1728 = 1.59+$). Hence an approximate result may be obtained by dividing the given space expressed in cubic feet by 1.6.

5. How many bushels of apples will a box hold that is 6 ft. square and 4 ft. deep ?

MODEL.

$$(6 \times 6 \times 4 \times 1728) \div 2747.7 = 90.56, \text{ exact number bushels.}$$

$$(6 \times 6 \times 4) \div 1.6 = 90, \text{ approximate number bushels } Ans.$$

6. How many bushels of potatoes will a bin hold that is 12 ft. long, 6 ft. wide, and 8 ft. high ?

Find the approximate number also.

7. How many bushels of turnips will a wagon box hold that is 11 ft. long, 3 ft. wide, and $2\frac{1}{2}$ ft. deep ?

Find an approximate answer also.

8. Find the number of cubic feet in a bin that will hold 75 bu. of parsnips.

MODEL.

$$(2747.7 \times 75) \div 1728 = 119.25+, \text{ exact number cubic feet.}$$

$$75 \times 1.6 = 120, \text{ approximate number cubic feet } Ans.$$

9. Find the exact number of cubic feet of space required to hold 125 bu. onions. Find an approximate answer also.

10. Find the exact number of cubic feet of space that will contain 300 heaped bushels. Find approximate answer also.

LESSON 83

A gallon equals about .1336 cu. ft. ($231 \div 1728 = .1336 +$).

1. Find the number of gallons of water contained in a tank 6 ft. long, 4 ft. wide, and 3 ft. deep.

MODEL. $(6 \times 4 \times 3 \times 1728) \div 231 = 538.6$, gallons exact method.
 $(6 \times 4 \times 3) \div .1336 = 538.9 +$ gal., approximate result *Ans.*

2. How many gallons of water will a cistern 6 ft. square and 8 ft. deep hold? Find the approximate result also.

3. From a rectangular cistern 10 ft. long, 8 ft. wide, and 6 ft. deep, 100 barrels of $31\frac{1}{2}$ gal. each were drawn. How many gallons remained in the cistern, if it was full at first?

4. How many hogsheads of water can be contained in a tank 8 ft. by 7 ft. and 9 ft. deep?

5. Find the approximate number of gallons of water in a well $3\frac{1}{2}$ ft. in diameter and 30 ft. deep, if the well is $\frac{1}{4}$ full.

6. How many cubic feet of space will be required to contain 425 gallons?

MODEL. $(231 \times 425) \div 1728 = 56.81$ cu. ft. by exact method.
 $.1336 \times 425 = 56.78$ cu. ft., approximate result *Ans.*

7. How many cubic feet of space will be required to contain 46 barrels?

8. Find the approximate number of cubic feet in a cistern that will contain 36 hogsheads.

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To find the approximate number of barrels a cistern will hold, divide the contents (expressed in cubic feet) by 4.21, the number of cubic feet, nearly, in a barrel.

9. How many barrels will a cistern hold that is 10 ft. long, 8 ft. wide, and 12 ft. deep?

10. Find the number of barrels in a cylindrical cistern 8 ft. in diameter and 10 ft. deep.

11. How many barrels of water will be contained in a tank 6 ft. 6 in. square and 8 ft. deep?

12. Find the approximate number of gallons of water in a tank 8 ft. by 6 ft. by 4 ft., if the tank is $\frac{3}{4}$ full.

13. Find the approximate number of cubic feet of space that will be required to contain 500 bu. of corn in the ear.

14. Find the exact number of gallons that a pan 22 in. long, 7 in. wide, and 6 in. deep will hold.

REVIEW WORK

LESSON 84

1. At 15¢ a square yard, how much will it cost to sod a piece of ground $82\frac{1}{2}$ ft. by 132 ft.?

2. Find the cost of 36 joists 18 ft. long, 12 in. wide, and $2\frac{1}{2}$ in. thick, at \$1.30 per hundred feet board measure.

3. Find the cost, at 25¢ a yard, of fencing a rectangular field containing 24 A., if its width is 60 rd.

4. Find the number of posts required for a fence around a piece of ground 875 ft. by 910 ft., if the posts are to be set 7 ft. apart.

5. How wide is Brussels carpet? How wide is ingrain carpet?

6. A quarter-section of land equals how many acres?

7. Find the cost of $4\frac{1}{4}$ doz. handkerchiefs at 3.60 a doz.

8. A druggist bought a pound of quinine for \$5.12 and sold it at the rate of 30 gr. for 10¢. How much did he gain?

9. If $\frac{2}{3}$ of $\frac{2}{3}$ of the cost of house and lot is \$1700, what is the whole cost?

10. If John can do a piece of work in 5 days, what part of the work can he do in $\frac{1}{2}$ of a day?

11. Mr. Santee covered the floor of his dining room, 20 ft. by 12 ft., with Brussels carpet. How many yards were used, the strips running lengthwise?

Find the cost of the carpet at \$1.35 per yard.

12. Find the cost of 50 boards 16 ft. long, 18 in. wide, at \$1.10 per hundred board feet.

13. From a hogshead containing 63 gallons, 7 gallons leaked out. What per cent was lost?

LESSON 85

1. How many square inches of paper will be needed to cover a box in the shape of a cube, if its volume is 27 cu. in.?

2. A school uses 36 pens a week. How many gross of pens will be needed for a term of 40 wk.?

3. A man sold 26 chickens to a butcher, which was $12\frac{1}{2}\%$ of all he raised. How many chickens had he left?

4. Find the amount of \$320 for 3 yr. 6 mo. 18 da., at 5%.

5. A man owning 216 A. of land sold 40% of it to one man and $37\frac{1}{2}\%$ of it to another. How many acres were left?

6. An automobile ran 62.5 miles in one day and 25% farther the next day. How many miles did it run in both days?

7. A merchant purchased 25 bu. 1 pk. 2 qt. of damsons, but $11\frac{1}{3}\%$ of them were unfit for use. How many bushels were good?

8. For what is Troy weight used? Avoirdupois weight? How many grains in an avoirdupois pound?

9. 350 Troy pounds equal how many avoirdupois pounds?

10. What number must be multiplied by $8\frac{2}{3}$ to produce $32\frac{1}{2}$?

11. What is the least common multiple of 6, 15, 18, 20?
12. A man sold a house for \$20,608, which was 15% more than it cost him. Find the cost of the house.
13. William Good owes Francis Drake \$160, payable in 90 days at 6%. Write a promissory note, giving place and date.
14. How much money must Good pay Drake if the note is paid when it is due?
15. If I borrow \$790 from my neighbor for 45 days, at 6%, how much must I pay at the expiration of the time?

LESSON 86

1. What is the ratio (relation) of $12\frac{1}{2}\%$ to $87\frac{1}{2}\%$?
2. What is the entire surface of a cylinder whose perimeter is 9 in. and altitude 6 in.?
3. If 6 men mow 30 acres of grass in 3 days, in how many days can 4 men mow the same number of acres?
4. I bought a turkey weighing 9 lb. 9 oz. for \$1.14 $\frac{3}{4}$. How much was that per pound?
5. Find the value of a pile of wood 24 ft. long, 4 ft. wide, and 6 ft. high, at \$5.25 a cord.
6. If $66\frac{2}{3}\%$ of a dozen oranges cost 18¢, how much will 40 oranges cost?
7. A man sold a watch for \$60, which was 150% of its cost. Find the cost.
8. When 25% and $16\frac{2}{3}\%$ of a sum of money is spent, \$1200 remains. What is the original sum?
9. The difference between $12\frac{1}{2}\%$ and $11\frac{1}{3}\%$ of a number is 80. What is the number?

10. When butter was sold at $83\frac{1}{3}\%$ of cost, there was a loss of 5¢ per pound. How much would have been lost by selling it for 80% of the cost?

11. An avoirdupois pound is what per cent of a Troy pound?

12. At \$16 per M., find the cost of 25 joists 20 ft. long, 8 in. wide, and 3 in. thick.

13. The sum of two numbers is $255\frac{3}{4}$. What is the larger number if the smaller number is 98.25?

14. How many half-inch cubes are equal to a two-inch cube?

LESSON 87

1. If $10\frac{1}{2}$ yd. of silk cost \$15 $\frac{3}{4}$, how much will $22\frac{1}{2}$ yd. cost?

2. At $33\frac{1}{3}\%$ each, how many arithmetics can be bought for $33\frac{1}{3}\%$ of \$27?

3. A number diminished by 35% of itself is 651. What is the number?

4. A can do a piece of work in 10 days, and B in 6 days. What fractional part of the work can each do in 1 day? What fractional part can they both do in a day, working together?

5. How many acres are there in a circular field whose diameter is 80 rd.?

6. A man bought a piece of land 90 rd. long and 80 rd. wide at \$75 an acre and sold it for \$4050. Find the gain per cent.

7. Find the interest of \$500 from Sept. 1 to Nov. 29, at 6%.

8. If a merchant sells coffee at 35¢ a pound, he gains 25%. Find the cost.

9. The area of a field, having the form of a trapezoid, is 47 acres. Find its altitude, if its parallel sides are 190 rd. and 130 rd., respectively.

10. What is interest? Principal? Amount?

11. What is a bill? An account?

12. Define debtor. Creditor. Decimal fraction.

13. $\frac{1}{12}$ of 60 is what per cent of $\frac{1}{4}$ of 60?

14. If 2 oz. of cinnamon cost $2\frac{1}{2}$ ¢, how much will $1\frac{3}{4}$ oz. cost?

15. What is the per cent of gain if an article that cost $\$ \frac{1}{3}$ is sold for $\$ \frac{1}{2}$?

16. 1 is 2% of what number? $5\frac{1}{2}$ % of what number?

17. 18 hours are what per cent of a day?

18. 43.8 da. are what % of a year (365 da.)?

19. If the difference in time between two places is 2 hr. 20 min., what is the difference in longitude?

20. What is longitude? What is latitude?

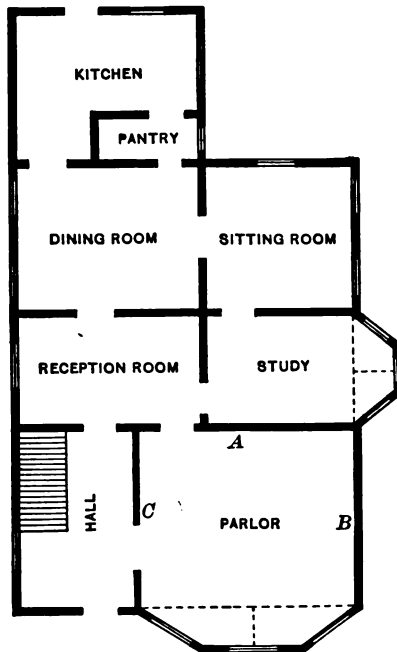
21. Threescore and ten is what per cent of a gross?

22. I bought 12 yd. of cloth for \$24, but the cloth being damaged, I sold 75% of it at $\$1\frac{5}{8}$ a yard and the remainder for cost. How much did I lose?

23. If a man gains in business \$2120.07 in 1 yr. 5 mo., how much will he gain at the same rate in 2 yr. 3 mo.?

LESSON 88

The following drawing represents the first-floor plan of a frame house, on a scale of $\frac{1}{16}$ in. to 1 ft. The height of the ceiling is 9 ft.



1. Find by measurement the length and width of the hall; parlor; reception room; sitting room; dining room; kitchen; pantry.
2. Make a copy of the above plan on a scale of $\frac{1}{8}$ in. to 1 ft.

3. How many bundles of plastering laths will be required for the walls and ceiling of the dining room, deducting two doors 3 ft. by 7 ft., one door 4 ft. by 7 ft., one door $2\frac{1}{2}$ ft. by 7 ft., and two windows 3 ft. by 6 ft.? (See Lesson 88.)

4. Find the cost of plastering the dining room at 14¢ a square yard, deducting one half the area of doors and windows.

5. How many double rolls of wall paper will be required to cover the walls and ceiling of the dining room, deducting full area of doors and windows?

6. Find the cost of ingrain carpet, at 90¢ a yard, for the dining room, if the strips run lengthwise.

7. How much will picture molding for the dining room cost, at $3\frac{1}{2}$ ¢ a foot, deducting for windows and doors?

8. Find the cost of plastering the ceiling of the parlor at 17¢ a square yard.

9. How much will it cost to plaster the kitchen walls and ceiling, at 25¢ a square yard, making full deductions for three doors 3 ft. by 7 ft., two windows 3 ft. by 6 ft., and wainscoting 3 ft. high?

10. How many yards of rag carpet will be needed for the kitchen floor, if the carpet is 1 yd. wide and the strips run the short way of the room?

11. How much will it cost to wainscot the kitchen 3 ft. high, at $6\frac{1}{4}$ ¢ a square foot, deducting for doors described in Ex. 9? No allowance for windows.

12. How much will it cost, at \$1.35 a yard, to carpet the sitting room with Brussels carpet?

LESSON 89

1. I have a lot 90 ft. long and 75 ft wide, which is surrounded by a tight board fence 6 ft. 3 in. high. Find the cost of painting of both sides of the fence at $6\frac{3}{4}\phi$ a square yard.

2. What is a complex fraction? Read: $\frac{\frac{2}{3}}{1 \times \frac{3}{4}}$; $\frac{7\frac{1}{2} + \frac{1}{3}}{16\frac{1}{2} - \frac{3}{4}}$.

3. Simplify the following complex fractions:

$$\frac{28 - \frac{1}{2}}{\frac{2}{3} \times \frac{3}{7}}; \frac{4\frac{1}{2} - 2\frac{3}{4}}{8 \div 2\frac{3}{4}}; \frac{1 + \frac{2}{3} \text{ of } \frac{9}{12}}{2\frac{1}{2} - \frac{5}{9}}.$$

4. A bank clerk's salary is \$1800 a year. If he saves $16\frac{2}{3}\%$ of it a year, how many years will it take him to save enough to pay for 36 acres of land at \$37 $\frac{1}{2}$ an acre?

5. If 35% of a car load of cabbage is sold, and $33\frac{1}{3}\%$ of the remainder is damaged, what part of the cabbage was salable?

6. How many steps, each $2\frac{1}{2}$ ft. long, will a man take in walking around a city square, each side of which is 500 ft. long?

7. At $\frac{1}{2}\phi$ an ounce, how much must you pay for $2\frac{1}{2}$ lb. of pork?

8. The diameter of a half dollar is $1\frac{3}{16}$ in. Find its circumference.

9. Measure the diameter of a quarter dollar and calculate the area of one side.

10. What per cent of a rod is $2\frac{3}{4}$ feet?

11. A man sold 25% of his chickens. He afterward bought 13 chickens and then had 37. How many chickens had he at first?

12. A boy gave $33\frac{1}{3}\%$ of his marbles to his brother and 15 to his sister. If he then had 35 marbles left, how many had he at first?

13. A commercial traveler hired a horse and buggy for 40¢ an hour. How much must he pay for their use from 7.30 A.M. till 4.15 P.M.?

14. If $2\frac{1}{2}$ qt. of onions cost 25¢, how much will 15 qt. cost?

15. $12\frac{1}{2}\%$ of a certain number is 3 less than $16\frac{2}{3}\%$ of it. What is the number?

LESSON 90

1. Find the area of a rectangle 30 ft. long and 20 ft. wide. Find the area of another rectangle whose dimensions are two times the dimensions of the first rectangle. The area of the second rectangle is what per cent of the area of the first?

2. \$60 is 150% of what John paid for a sleigh. Find the cost of the sleigh.

3. How much money must a man invest at 6% in order to realize an annual income of \$45.24?

4. How many acres are there in a square mile?

5. What per cent of a square mile are 144 acres?

6. \$32 is 8% of what Mr. Dodge paid for an automobile. Find the cost.

7. A surveyor finds that a tract of land extends northwest 80 rd., then northeast 180 rd., then southeast 80 rd., and, lastly, southwest 180 rd. Make a drawing of the land on a scale of $\frac{1}{2}$ in. to 20 rd. Find the area of the plan and of the land.

8. What is a right angle? An acute angle? An obtuse angle?

9. What is a board foot? A board foot is what per cent of a cubic foot?

10. Find the difference in cubic inches between 5 qt. dry measure and 5 qt. liquid measure.

11. $2^{\circ} 20'$ of latitude equal how many miles?

12. A man owns a piece of land 40 rd. square and another piece $\frac{1}{4}$ of a mile square. The area of the first is what per cent of the area of the second?

13. If a boy can earn 90¢ a day, how long will it take him to earn $\$24\frac{3}{10}$?

14. $\frac{4}{5}$ of 54 is what per cent of $\frac{3}{4}$ of 88?

15. How many shingles will be required to cover 1 sq. ft., if the shingles average 4 in. in width and are laid 4 in. to the weather?

16. How many shingles that average 4 in. in width will be required to lay the roof of the house described on page 100, if the first course is doubled and the shingles are laid 4 in. to the weather?

17. How much money must be loaned for 1 year at 4% to yield \$24 interest?

18. If a man can walk 14.8 mi. in 4 hr., how far can he walk in 6 da. of 10 hr. each?

19. What is the value of a pile of wood 60 ft. long, 8 ft. wide, and 8 ft. high, at \$4.75 a cord?

20. How many bushels are there in 9676.89 cu. in.?

COMMISSION

LESSON 91

A **Commission Merchant** is a person who buys and sells merchandise for another.

An **Agent** is a person authorized to transact business for another. He buys, sells, and rents property; he collects money, lends money, etc.

Commission is a percentage charged by commission merchants and agents for transacting business. It is reckoned on the amount invested, sold, or collected.

The **Net Proceeds** is the sum left after the commission and other expenses have been deducted.

The person sending goods to be sold on commission is called the **Consignor**, or **Shipper**; the goods sent, a **Consignment**; and the person to whom the goods are sent, the **Consignee**.

1. Define: commission merchant; agent; commission; net proceeds; consignor; consignment; consignee.

2. Upon what is commission reckoned?

3. A commission merchant sold a car load of potatoes for \$270. What was his commission at $3\frac{1}{2}\%$?

4. A real estate agent sold a house and lot for \$6250, charging $2\frac{1}{2}\%$ commission. Find his commission.

5. A flour merchant sold 860 bbl. of flour at \$6.75 a barrel. What was his commission at $2\frac{1}{2}\%$, and what was the amount paid over to the consignor?

6. An agent collects 80% of a debt of \$3680. What is his commission at $4\frac{1}{2}\%$, and how much does he pay over to his employer?

The commission is reckoned on the sum collected, that is, on 80% of \$3680.

7. An agent collected 75% of a debt of \$2500, for which he received 5% commission. How much did the creditor receive?

LESSON 92

1. When the commission is \$192.30, and the rate 5%, what is the amount of the sales?

MODEL. $\$192.30 \div .05 = \3846 Ans.

Since the commission, \$192.30, equals the amount of the sales multiplied by the rate expressed decimally, it is evident that the commission divided by the rate will give the sum on which the commission is reckoned.

2. A commission of \$154.20 was charged by a commission merchant for selling apples, his rate being $3\frac{1}{2}\%$. Find the amount of the sales.

3. My agent charged me \$42.31 $\frac{1}{2}$ for collecting a bill. What was the amount of the bill, his rate of commission being 5%?

4. A New York commission merchant sold a consignment of pork for a Chicago dealer and remitted \$440.37 proceeds to the consignor. The rate of commission being $5\frac{1}{2}\%$, how much did the pork bring?

MODEL. $\$440.37 \div .94\frac{1}{2} = \466 Ans.

Since the commission merchant retained $5\frac{1}{2}\%$, or .05 $\frac{1}{2}$, of the selling price as his commission, he remitted to his employer $100\% - 5\frac{1}{2}\%$, or $94\frac{1}{2}\%$, of the selling price. Hence \$440.37 must equal .94 $\frac{1}{2}$ of the selling price, which is $\$440.37 \div .94\frac{1}{2}$ or \$466.

5. Mr. A collected a claim for me, charging 10% commission. If he paid me \$238.77, find the amount of the claim.

6. Mr. Phillips sold a city building lot at $2\frac{1}{2}\%$ commission. He paid to his employer \$7800. What was the value of the sale?

7. A commission merchant was paid \$27 for selling 300 bbl. of flour at \$4 a barrel. What was the rate of commission?

MODEL. $\$4 \times 300 = \1200 , sum received for flour.

$\$27 \div \$1200 = 2\frac{1}{4}\%$ Ans.

Since the commission, \$27, is obtained by *multiplying* the sum received for the flour, \$1200, by the rate expressed decimally, it is evident that the rate equals \$27 *divided* by \$1200, which gives .02 $\frac{1}{4}$, or $2\frac{1}{4}\%$.

LESSON 93

1. I paid an agent \$41.40 for collecting a claim of \$720. What was the rate of commission?

2. If \$63 is charged for collecting \$2520, what is the rate?

3. When \$124.80 commission is paid for selling \$3840 worth of corn, what is the rate?

4. A manufacturer paid an agent \$259.02 for selling goods on a commission of $4\frac{1}{2}\%$. What was the amount of his sales?

5. An agent remitted \$71,295 from a sale of flour after deducting his commission of \$1455. Find the rate of commission.

6. A commission merchant sold flour at \$4.50 a barrel, on $3\frac{1}{2}\%$ commission. His commission was \$126. How many barrels did he sell?

7. A commission merchant sold 250 boxes of oranges, each box containing 12 doz., at 36¢ a dozen. What was his rate of commission if he received \$59.40 for making the sale?

8. A commission merchant sold a consignment of cotton for \$2500. After deducting his commission of 3% and \$54.80 storage and freight, what amount was paid to the consignor?

9. An agent sold 80 tubs of butter, 56 lb. each, at 20¢ a pound. After deducting 5% for selling and \$46.80 shipping expenses, what amount was paid to the consignor?

10. An agent sold goods which cost \$1250 for \$1720. What per cent profit did his employer make if the agent charged him \$87½ commission, \$25 freight, and \$12½ cartage?

11. At a commission of 3½%, an agent sold wheat and remitted to his employer \$6948. What was the amount of the sale?

12. An agent's commission for selling a city building lot was \$423.75. Find the selling price if the rate of commission was 3%.

TRADE DISCOUNT

LESSON 94

Sometimes a certain percentage is deducted from the amount of a bill, or of a debt, for cash payment, or for other reasons. It is not an unusual thing for manufacturers, "firms," or "houses" to deduct two or more percentages from the list price of goods. These deductions are known in business as **Commercial**, or **Trade Discounts**.

1. I purchased 28 yards of carpet, the list price being \$1.25 a yard, at 10% discount. How much did the carpet cost me?

2. I bought pocket knives, listed at \$1.50 each, at 20% off. How much did they cost me?

3. A man sold a bill of goods amounting to \$840 at a discount of $12\frac{1}{2}\%$ for cash. What was the discount?

4. J. C. Madden, Wilkesbarre, Pa., bought of the American Book Company, New York:

48 Barnes's Elementary Geography @ \$.55,

48 Natural Elementary Geography @ .60,

60 Natural Advanced Geography @ 1.25.

Find the net amount of the bill, allowing a discount of 20%. Make out the bill.

When two or more discounts are allowed, the first is taken from the list price; the second from the remainder; the third from the second remainder, etc.

5. A man bought an automobile, the list price of which was \$600, at a discount of 20% and 10% off for cash. What was the net cost?

MODEL. $\$600 \times .80 = \$480 = 20\% \text{ off.}$

$\$480 \times .90 = \432 Ans.

6. Mr. Wilson bought 300 wagons, the list price being \$70, at 30% and 10% off for cash. Find the net cost of the wagons.

LESSON 95

1. I bought shovels, listed at \$1.50 each, at 50% and 8% off. How much did they cost me?

2. A manufacturer sold a bill of goods amounting to \$260, at 30% discount and $2\frac{1}{2}\%$ off for cash. Find the net price.

3. What is the difference between the net value of a bill of goods for \$1000 at 20% and 5% off, and the net value of a bill for the same amount at 25% off?

4. I am offered a bill of goods, list price \$1000, at 45% discount, or at 30% and 15% off. Which is the better offer?

5. Find the net price of a \$900 piano, if sold at a discount of 40% and 10%.

6. I paid \$114.20 for a mowing machine, after deducting 20% from the list price. Find the list price.

7. Which is better, and how much, a discount of 40% and 10%, or a discount of 20% and 30%, from a bill of \$3350?

8. Find the auctioneer's commission for selling \$765.80 worth of silverware, his rate being $4\frac{1}{2}\%$.

9. If an auctioneer sells goods at 4% commission and receives \$30.28, what amount does he sell?

10. Mr. Detrick paid an attorney \$29.25 for collecting a bill of \$487.50. What was the rate of commission?

11. Find the net price of a bill of goods amounting \$580, at 30% and $2\frac{1}{2}$ % off.

12. The Scranton School Board bought of the Bloom-
burg School Desk Company a lot of desks amounting
\$900, at a discount of 20%, 10%, and 5%. Find the net
amount of the bill.

13. A merchant bought a bill of hardware amounting
to \$469.20 subject to the following discounts: 20%, 10%,
and 5%. Find the net amount of the bill.

14. Find the net amount of a bill of goods for \$300
subject to the following discounts: $12\frac{1}{2}$ %, 5%, and 2%.

15. After a discount of 20% for cash a bicycle was sold
for \$28.80. Find the list price.

TAXES

LESSON 96

Every state, county, township, city, and borough needs money to maintain schools; to build roads and streets, and to keep them in good condition; to construct sewers; to furnish lights, police protection, and protection against fires, etc. This money, which is called a **tax**, must be furnished by the people. A **Tax**, therefore, may be defined as a sum of money assessed on persons, property, certain incomes, productions, etc., to be used for public purposes.

In some states there is levied what is called a **Poll Tax**. (Poll means head.) This tax varies in amount in different states, and is assessed on the person of each male citizen over 21 years of age without regard to property.

A **Property Tax** is a tax on property, and is a certain percentage of its assessed value.

Property is divided into two classes, real estate and personal property.

Real Estate consists of immovable property, such as lands and houses.

Personal Property consists of movable property, such as furniture, utensils, merchandise, cattle, money, etc.

Assessors are persons appointed to make a list of all the persons and property liable to taxation in a specified

district, to fix the value of each person's taxable property, and to apportion the taxes.

1. What is a tax ? Poll tax ? Property tax ?
2. What is real estate ? Personal property ?
3. Name some purposes for which states, counties, cities, and boroughs levy taxes.
4. State the duties of assessors.
5. How much tax does Amos Ross pay on his property valued at \$3000 if the tax rate is $1\frac{1}{2}\%$?

MODEL. $\$3000 \times .01\frac{1}{2} = \45 Ans.

LESSON 97

1. If my property is valued at \$3600, and the tax rate is $2\frac{1}{4}\%$, how much is my tax ?
2. What is a man's tax whose property is assessed at \$4500 in a city in which the tax rate is $1\frac{3}{4}\%$?
3. Find Mr. Wilson's tax, the assessed value of whose real estate is \$13,680, and personal property \$7360, at the rate of $5\frac{1}{2}$ mills on a dollar.
4. The assessed value of a man's property is \$30,000. If he pays $3\frac{1}{2}$ mills city tax, 13 mills school tax, $\frac{1}{2}$ mill poor tax, and \$1.50 poll tax, what is the amount of his taxes ?
5. I own real estate worth \$6800, personal property worth \$3150, and have \$4360 on interest. I pay $4\frac{3}{4}\%$ on $\frac{1}{4}$ of the value of the real estate, 5% on $\frac{1}{3}$ of the value of the personal property, and 3 mills on the money at interest. How much tax do I pay ?

6. The assessed value of the property of a town is \$192,000. What must be the rate in order to raise \$3072 tax?

MODEL. $\$3072 \div \$192,000 = .016$, or 1.6%.

7. A school district needs \$12,000 for building purposes, \$7500 for salary of teachers, and \$2500 for other expenses. The state appropriates \$1500, and the rest is to be raised on taxable property valued at \$4,100,000. What is the tax rate?

8. At the rate of 9 mills on the dollar, what must be the assessed value of property to yield \$38,520 tax?

MODEL. $\$38,520 \div \$.009 = \$4,280,000$ Ans.

Since \$1 of property yields 9 mills tax, to yield \$38,520 tax it will require as many dollars of property as \$.009 is contained times in \$38,520, or \$4,280,000.

9. A tax of \$180 was paid on property in a district where the rate of taxation was $1\frac{1}{2}\%$. Find the assessed value of the property.

10. In a city containing 3360 voters, a tax of \$11,040 is to be raised for various purposes. If each voter pays \$1.25 poll tax, and the remainder is raised by a tax of 3 mills on the dollar, what is the assessed valuation of the property?

INSURANCE

LESSON 98

Insurance is a contract by which one party, usually a company, agrees to indemnify another against loss or damage.

For example, Mr. Sands has a contract with the Westchester Fire Insurance Company of New York, by which the company agrees to insure his house for \$3500 against loss, for the sum of \$45.50 for a period of three years. If the house is totally destroyed by fire, Mr. Sands will receive \$3500, but if it is only partially destroyed, he will receive from the company a sum in proportion to the loss.

The contract is called the **Policy**. The sum of money to be paid in case of loss is called **Insurance**. The sum of money paid for the insurance is called the **Premium**.

There are two kinds of insurance, **Property Insurance** and **Personal Insurance**.

Property insurance only will be considered at this time.

There are several kinds of property insurance, as *fire*, *accident*, *marine*, *stock insurance*, etc.

It is customary for companies to insure property for 1, 3, or 5 years. The premium is computed at a certain per cent of the sum for which the property is insured, or at a certain number of cents for each \$100 worth of insurance.

As an inducement to insure property for a period longer than 1 year, companies make a reduction on the premium. Some of them make the 3-year rate two times the annual rate, and the 5-year rate three times the annual rate. As a rule, property is not insured for its full value.

1. Define insurance; policy; premium.
2. What is the premium for insuring a barn for \$3500 at $1\frac{3}{4}\%$?
3. A merchant has goods worth \$4800 insured for $\frac{3}{4}$ of their value at $1\frac{3}{4}\%$. What is his premium?

LESSON 99

1. What will be the cost of insuring 800 bbl. of flour worth \$4.50 a barrel at $\frac{7}{8}\%$?
2. How much will it cost to insure a house for \$3000 at $\frac{5}{8}\%$, and the furniture for \$1600 at $\frac{3}{4}\%$?
3. A merchant has a cargo of goods worth \$3600 insured for $\frac{3}{4}$ of its value at $1\frac{1}{4}\%$. Find the premium. If the goods are destroyed, how much insurance will the merchant receive?
4. A house costing \$6400 is insured for $\frac{7}{8}$ of its value for 5 yr. The 5-year rate is three times the annual rate. The annual rate is \$.65 for each \$100 of insurance. How much did the insurance cost?

MODEL. $\frac{7}{8} \times \$6400 = \$5600 = \text{amount of insurance.}$

$3 \times \$.65 = \$1.95 = \text{cost of } \$100 \text{ worth of insurance for 5 yr.}$

$56 \times \$1.95 = \$109.20, \text{ premium for 5 yr. } Ans.$

5. I have my house insured for \$2500, and my furniture for \$1000, for a term of 3 years. The 3-year rate is two times the annual rate, the annual rate being \$.75 a hundred. Find the amount of both premiums.

6. Mr. Long paid \$40 for an insurance of \$5000 on a stock of goods. Find the rate of insurance.

SUGGESTION. $\$40 \div \$5000 = \text{Ans.}$

7. If I paid \$43 for insuring property valued at \$8600, what was the rate?

8. The premium for insuring a house for $\frac{3}{4}$ of its value, at 3%, is \$108. What is the value of the house?

SUGGESTION. $\$108 \div .03 = \frac{3}{4}$ of the value of the house.

9. Mr. Robbins paid \$575 for the insurance of a cargo of wheat at $1\frac{1}{4}\%$. For what sum was it insured?

10. A merchant paid \$60 for insuring his stock of goods for $\frac{3}{4}$ of their value. What was the value of the goods if the rate is $1\frac{1}{2}\%$?

11. A cargo worth \$16,300 was insured at $3\frac{3}{4}\%$ for 90% of its value. Find the actual loss of the owner in case of shipwreck.

12. A factory which had been insured for \$32,000 for 10 years at $1\frac{3}{8}\%$, was totally destroyed by fire. How much did the amount received from the company exceed the sum of the premiums paid?

RATIO

LESSON 100

Ratio is the relation which two similar things have to each other in respect to size.

For example, the line AB is one half as long as the line CD . Therefore the ratio of AB to CD is $\frac{1}{2}$.

A ————— B

C ————— D

Again, 1 foot is $\frac{1}{3}$ of a yard. Therefore the ratio of 1 foot to 1 yard is $\frac{1}{3}$.

1. A quart is what part of a peck? What is the ratio of a quart to a peck?

2. A peck is what part of a bushel? What is the ratio of a peck to a bushel?

3. 6 is what part of 18? What is the ratio of 6 to 18?

4. 18 is how many times 6? What is the ratio of 18 to 6?

The ratio of two numbers is found by dividing the first of the two numbers compared by the second. For example, the ratio of 8 to 4 is 2; it is obtained by dividing 8 by 4. The ratio of 4 to 8 is $\frac{1}{2}$, since $4 \div 8 = \frac{1}{2}$.

The first of the two numbers compared is called the **Antecedent**; the second the **Consequent**. In the ratio 6 to 2, the antecedent is 6 and the consequent 2.

Ratio is usually indicated by placing the colon (:) between the two numbers compared. Thus, 6 : 2 means the

ratio of 6 to 2. Ratio is sometimes expressed by the sign of division; thus, $9 \div 3$. It is also expressed by writing the numbers in the form of a common fraction; thus, $\frac{1}{3}$.

5. What is the ratio of 5 to 6? Of 6 to 5? Of 7 to 8? Of 8 to 7?

6. What is the ratio of 4 ft. to 12 ft.? Of 15 min. to 1 hr.? Of 16 days to 4 days? Of 4 months to 1 year? Of 12 to 36?

7. Give the ratio of 18 to 9; 1 qt. to 1 gal.; 2 oz. to 1 lb.; 8 oz. to 3 lb.; of 9 to 15; of 18 to 12; of 21 to 7.

8. What is the ratio of 12% to 24%? Of 6% to 12%?

9. What is the ratio of 20% to 100%? Of $12\frac{1}{2}\%$ to 25%? Of $12\frac{1}{2}\%$ to $37\frac{1}{2}\%$? Of $33\frac{1}{3}\%$ to $66\frac{2}{3}\%$? Of \$1 to $33\frac{1}{3}\%$?

LESSON 101

In any ratio the antecedent is the dividend, the consequent the divisor, and the ratio the quotient. The ratio is always an *abstract number*.

1. How is the ratio found when the antecedent and consequent are given? When the antecedent and ratio are given, how is the consequent found? When the consequent and ratio are given, how is the antecedent found?

2. The antecedent is 18, the ratio 3. What is the consequent?

3. The consequent is 5, the ratio 6. What is the antecedent?

4. The consequent is 7, the ratio 3. What is the antecedent?

5. The antecedent is $3\frac{1}{3}$, the consequent 10. What is the ratio?

6. What is the ratio of $\frac{1}{4}$ to $\frac{1}{2}$? Of $\frac{1}{2}$ to $\frac{1}{4}$? Of $\frac{1}{8}$ to $\frac{1}{4}$? Of $\frac{1}{4}$ to $\frac{1}{8}$? Of $\frac{1}{2}$ to $\frac{3}{4}$? Of $\frac{1}{3}$ to $\frac{1}{2}$? Of $16\frac{2}{3}$ to 100? Of $8\frac{1}{3}$ to 100? Of 100 to $8\frac{1}{3}$? Of $6\frac{1}{4}$ to 100? Of 100 to $6\frac{1}{4}$?

7. What is the relation of 42 men to 21 men? Of 12 apples to 9 apples? Of 13 to 65? Of 72 to 18? Of $\frac{3}{4}$ to 2? Of 8 to $2\frac{1}{2}$? Of $3\frac{1}{3}$ to $2\frac{2}{3}$? Of 80¢ to \$8?

8. What is the ratio of \$25 to \$425? Of $\frac{3}{16}$ to $\frac{1}{4}$? Of 43.2 to 7.2? Of .3 to $2.6\frac{1}{3}$? Of $5\frac{1}{2}$ to $16\frac{1}{2}$?

9. What is the ratio of 14 to 7? What is the ratio when the antecedent is 2 times the consequent?

10. What is the ratio of 7 to 14? What is the ratio when the consequent is 2 times the antecedent?

11. What is the ratio when the antecedent is 3 times the consequent? 4 times? 5 times?

12. What is the ratio when the consequent is 3 times the antecedent? 4 times? 5 times? 8 times?

13. What is the ratio when the antecedent is $\frac{2}{3}$ of the consequent? When the consequent is $\frac{2}{3}$ of the antecedent?

14. What is the ratio of $87\frac{1}{2}$ ¢ to \$7? Of 3 ft. 5 in. to 7 ft.? Of $72\frac{3}{4}$ to $363\frac{3}{4}$? Of 1 to .1? Of 1 to 1.5? Of $5\frac{1}{2}$ yd. to 1 rd.? Of 240 rd. to 1 mi.? Of 1760 ft. to 1 mi.?

LESSON 102

1. By the ratio method, find the cost of 6 lb. of sugar if 3 lb. cost 21¢.

MODEL. The ratio of 6 lb. to 3 lb. is 2. Hence 6 lb. will cost 2 times as much as 3 lb. 2 times 21¢ = 42¢. *Ans.*

Solve the following problems by the ratio method :

2. If 4 bu. of apples cost \$3, how much will 20 bu. cost?

3. If 5 tons of coal cost \$17.50, how much will 25 tons cost?

4. If 6 bu. of wheat cost \$4.80, how much will 2 bu. cost?

MODEL. The ratio of 2 bu. to 6 bu. is $\frac{1}{3}$. Hence 2 bu. will cost $\frac{1}{3}$ as much as 6 bu. $\frac{1}{3}$ of \$4.80 = \$1.60 *Ans.*

5. If 10 tons of hay cost \$175, how much will 7 tons cost?

6. If a boy travels 36 mi. on his bicycle in 4 hr., how many miles can he travel in 3 hr.?

7. If 8 men can build a wall in 12 days, how many men will be required to do it in 16 da.?

SUGGESTION. The ratio of 12 da. to 16 da. = $\frac{3}{4}$. $\frac{3}{4}$ of 8 men = 6 men *Ans.*

8. If 8 men can build a wall in 12 days, how many days will 6 men require?

9. If 4 men can mow a field in 34 days, how many men will be required to mow the field in 17 days?

10. If 12 bu. of corn can be bought for \$6.66, how many bushels can be bought for \$53.28?

11. If 9 men can lay the brick walls of a house in 22 da., how long will it take 11 men to do the same work?

12. How long will it take 6 horses to do what 4 horses can do in 24 days?

13. If 100 bu. of wheat make 20 bbl. of flour, how many barrels of flour will 80 bu. make?

14. If a clock loses 3 min. in 36 hr., how much time will it lose in a week?

15. If 9 boys' suits cost \$96.33, how much will 1 doz. suits cost?

16. If a pole 30 ft. high casts a shadow 45 ft., what must be the height of a pole to cast a shadow 60 ft.?

LESSON 103

1. If $\frac{3}{4}$ of a yard of cloth cost \$2.40, how much will $\frac{3}{4}$ of a yard cost?

MODEL. The ratio of $\frac{3}{4}$ to $\frac{3}{4}$ is $\frac{3}{4} \div \frac{3}{4}$. Hence $\frac{3}{4}$ of a yard will cost $\frac{3}{4}$ of \$2.40, or \$2.70 *Ans.*

2. If $\frac{4}{5}$ of a ton of steel costs \$30, how much will $\frac{3}{5}$ of a ton cost?

3. If it takes 36 yd. of carpet 1 yd. wide to cover a floor, how many yards $\frac{3}{4}$ yd. wide will be needed to cover it?

4. $\frac{2}{10}$ of a tract of land is valued at \$3600. What is the value of $\frac{4}{5}$ of it?

5. If $\frac{5}{6}$ of a man's income is \$2500, what is $\frac{4}{5}$ of it?

6. If it takes $3\frac{3}{4}$ yd. of cloth to make two coats, how many yards will be needed for 16 coats?

7. There are $283\frac{1}{2}$ gal. in 9 bbl. How many gallons are there in 11 barrels?

8. A stenographer's salary for $8\frac{3}{10}$ months is \$830. Find his salary for a year at the same rate.

9. If $10\frac{1}{4}$ bu. of wheat cost \$12.30, how much will 7 bu. 3 pk. cost at the same rate?

10. How long will hay last 5 cows, which would last 8 cows 10 weeks?

11. John can do $1\frac{1}{2}$ times as much work in a day as his brother William. How long will it take John to do what William can do in 12 days? How long will it take William to do what John can do in 8 days?

12. If $3\frac{1}{3}$ bu. of wheat cost \$3, how much will $7\frac{2}{3}$ bu. cost?

13. What is the ratio of the perimeter of a 2-foot square to the perimeter of a 4-foot square?

REVIEW

LESSON 104

1. At $\frac{3}{4}$ ¢ each, how many pencils can I buy for 36¢?
2. Mr. Toomb sold potatoes which cost him 80¢ a bushel, at a loss of $12\frac{1}{2}\%$. If his loss was \$3.60, how many bushels did he sell?
3. What number increased by 20% of itself equals 50?
4. How many rods, yards, and feet are there in $\frac{3}{4}$ of a mile?
5. How many bushels of corn, at 40¢ a bushel, will pay for 2 T. 16 cwt. of coal at \$3.25 a ton?
6. What part of a mile is 60 rd.? What per cent of a mile is 80 rd.?
7. A house is insured for \$1800 at $\frac{3}{4}\%$ a year. Find the premium for 5 years.
8. At \$150 an acre, how much is a piece of land 20 rd. square worth?
9. A carpenter was 4 days and 6 hours building a garden fence. How much should he receive at \$2.50 a day, 10 hours making a day's work?
10. Find the cost of 4 reams and 8 quires of paper at $\frac{3}{8}$ of a cent a sheet.
11. Find the cost of $6\frac{3}{4}$ dozen magazines at $33\frac{1}{3}$ ¢ each.
12. Find the cost of $51\frac{1}{2}$ yd. of braid at $22\frac{1}{2}$ ¢ a yard.
13. What is the ratio of the area of a 2-foot square to the area of a 4-foot square?
14. What is the ratio of a square foot to a square yard?

15. A pipe discharges $842\frac{3}{16}$ gal. of water in 10 hours. How much does it discharge in 7 hours?

16. A pole 28 ft. high casts a shadow $64\frac{3}{10}$ ft. long. How long a shadow will a pole 21 ft. high cast at the same time of day?

17. How many rods are there in $255\frac{3}{4}$ feet?

18. What is the gain per cent if you buy for 16¢ and sell for 19¢?

19. What is the cost of $13\frac{1}{2}$ pounds of tea at the rate of $19\frac{1}{2}$ pounds for \$17.59 $\frac{1}{2}$?

LESSON 105

Find the gain or loss per cent :

1. If you buy for 8¢ and sell for 10¢. • If you sell for 14¢. For 15¢.

2. If you buy for 12¢ and sell for 9¢. If you sell for 13¢. For 17¢.

3. If you buy for 50¢ and sell for $\$7\frac{1}{2}$. If you sell for $\$3\frac{3}{8}$. For $\$5\frac{1}{8}$.

4. If $12\frac{1}{2}$ tons of iron cost \$190, how much will 20% of $172\frac{1}{2}$ tons cost?

5. I sold a cow for \$7.60 less than it cost me. I lost 38%. Find the cost.

6. Find the interest of \$600, at 6%, for 2 yr. 1 mo. 6 da.

7. At \$1.20 a rod, how much will it cost to build a fence around a circular piece of land whose diameter is 120 rods?

8. How much will it cost, at \$1.75 a perch, to lay the foundation walls of a house 50 ft. long, 20 ft. wide, 18 in. thick, and 8 ft. high? Use outside measurements.

9. A collector charged \$27 for collecting a debt of \$6750. Find the rate of commission.

10. Mrs. Edgar used a quart of milk each week day and 3 pints each Sunday. At 8¢ a quart, find her milk bill for the year 1900, the first day being Monday.

The examples in the rest of this lesson refer to the drawing on page 117.

11. How many yards of Brussels carpet will it take to cover the floor of the reception room, the strips to run the long way of the room?

12. How much will it cost to plaster the ceiling and walls of the reception room at 22¢ a square yard?

Deduct 2 doors 3 ft. by 7 ft., 1 door 2 ft. 6 in. by 7 ft., and 1 window 4 ft. by 6 ft.

13. How many double rolls of paper will be required for the ceiling and walls of the reception room? Deduct full area of doors and windows.

14. How many bundles of plastering laths will be needed for the reception room? Deduct doors and windows.

LESSON 106

1. If 20 lb. of rice cost \$1 $\frac{1}{4}$, how much will 5 lb. cost?

2. How many quarts of chestnuts, at 10¢ a quart, will pay for 16 lb. butter at 22 $\frac{1}{2}$ ¢ a pound?

3. Find the exact number of bushels contained in a bin 10 ft. long, 4 $\frac{1}{4}$ ft. wide, and 6 ft. deep.

4. The ice man delivered Mr. James an average of 25 lb. of ice daily for the months of June, July, and August, and 20 lb. daily for the months of September and October. Find the cost at 20¢ a hundred.

5. Find the area of a triangle whose base is 12 ft. and altitude 16 ft. State the dimensions of another triangle whose area is twice as large as the first.

6. A is 40° east of B . How much later is sunrise at B than at A ? When it is 2 o'clock P.M. at A , what time is it at B ?

7. If $\frac{2}{3}$ of the distance between two points is 40 rd. 3 yd. 2 ft. 10 in., find the whole distance. Express answer in feet.

8. If $2\frac{1}{2}$ qt. of sirup cost \$.15, how much will $4\frac{1}{2}$ gal. cost?

9. A tax of \$36 was paid on property in a town where the rate of taxation was $1\frac{4}{5}\%$. Find the assessed value of the property.

10. What is a promissory note? The face of a note? The maker of a note? The payee?

11. There is a loss of $12\frac{1}{2}\%$ on tomatoes sold at $17\frac{1}{2}\text{¢}$ a basket. Find the cost of the tomatoes.

12. A commission merchant sold goods to the amount of \$9000. After deducting his commission he remitted to his employer \$8640. Find the rate of commission.

13. 72 is $12\frac{1}{2}\%$ more than what number?

14. If the premium for insuring a house for its full value at $\frac{3}{4}\%$ is \$21.72, find the value of the house.

15. How many pounds in 4% of 1 ton?

16. If 20 men can do a piece of work in 7 days, how many men will be required to do the same work in 4 days?

LESSON 107

1. How many board feet in a board 16 in. wide at one end and 10 in. wide at the other, if its length is 18 ft.?

2. Find the cost of a pile of wood 28 ft. long, 4 ft. wide, and 8 ft. high at \$4.40 a cord.

3. A man sold 24.32 acres of his farm of 56 A. 48 sq. rd. What per cent of his farm was left?

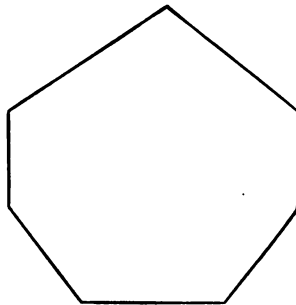
4. A man bought $25\frac{1}{4}$ yd. of cloth at $\$2\frac{3}{5}$ a yard. How many bushels of rye at $\$ \frac{4}{5}$ a bushel will be required to pay for it?

5. Find the volume of a cylinder, the circumference of whose bases is 24 in., and whose altitude is 18 in.

6. Find the area of the following polygon drawn to a scale of $\frac{1}{8}$ in. to 1 rd.

7. What is a polygon? Trapezoid? Trapezium?

8. How many cubes with an edge of 2 in. can be cut from a cube whose edge is 10 in. long, not considering waste in cutting?



9. How many square inches of paper would it require to cover the surfaces of the smaller cubes mentioned in the preceding problem?

10. Which will hold the more, 8 boxes 7 in. by 5 in. by 3 in., or 4 boxes 14 in. by 10 in. by 6 in.?

11. A quantity of medicine was made into 10-grain powders and sold for $\$12\frac{1}{2}$ at the rate of 5¢ a powder. How much medicine was used?

12. What is an isosceles triangle?

13. Find the volume of a triangular prism the area of whose base is 42 sq. ft., and whose altitude is 5 ft. 6 in.

14. If $\frac{2}{3}$ of a barrel of flour is worth \$4.26, how much is a barrel worth?

LESSON 108

1. Find the number of board feet of lumber necessary to lay the first and second floors of the house represented by the drawing on page 100, the inside measurements being one foot less than the outside measurements.

2. How many board feet will be needed to cover the roof of the same building? To cover the sides and ends, including gables? No allowance for doors and windows.

3. What is interest? Principal? Commission?

4. For what is circular measure used? Recite the table of circular measure.

5. What is an angle? Upon what does the size of an angle depend?

6. What is a protractor? The equator? Latitude? Longitude?

7. Draw a 3-inch square and show $87\frac{1}{2}\%$ of it.

8. I lost $33\frac{1}{3}\%$ of my money and spent 50% of the remainder for a wagon worth \$33. How much money had I at first?

9. $3\frac{1}{3}\%$ is what part of $13\frac{1}{3}\%$? $3\frac{1}{3}\%$ is what per cent of $13\frac{1}{3}\%$?

10. What is the sum of $\frac{5}{8}$ and $\frac{7}{8}$? What is their difference? Their product? The quotient of the greater divided by the less?

TABLES

LONG MEASURE

Long Measure is used in measuring lines or estimating distances.

The units employed in measuring length are, the *inch*, the *foot*, the *yard*, the *rod*, the *mile*, the *link*, and the *chain*.

LONG MEASURE	SURVEYORS' LONG MEASURE
12 in. = 1 ft.	7.92 in. = 1 li.
3 ft. = 1 yd.	25 li. = 1 rd.
$5\frac{1}{2}$ yd. } = 1 rd.	4 rd. } = 1 ch.
$16\frac{1}{2}$ ft. }	66 ft. }
320 rd. = 1 mi.	80 ch. = 1 mi.
1 mi. = 1760 yd. = 5280 ft. = 63,360 in.	

OTHER MEASURES. — 12 lines = 1 inch; 3 barleycorns = 1 inch; 4 inches = 1 hand, used in measuring the height of horses; 3.3 feet = 1 pace, used in approximating distances; 6 feet = 1 fathom, used in measuring depths at sea; 120 fathoms = 1 cable length; 6086.7 feet = 1 knot, a nautical or geographical mile; 60 geographical, or 69.16 common miles = 1 degree of latitude or longitude at the equator; 40 rods = 1 furlong; 8 furlongs = 1 mile; 3 miles = 1 league.

The Surveyors' chain = 4 rods = 66 feet = 792 inches long. The Engineers' chain is 100 feet long, divided into 100 links of 1 foot each.

SQUARE MEASURE

Square Measure is used in estimating areas or surfaces, as land, boards, etc.

The units employed are: the *square inch*; the *square*

foot; the *square yard*; the *square rod*; the *acre*; the *township*; the *square mile*; the *square link*, and the *square chain*.

SQUARE MEASURE	SURVEYORS' SQUARE MEASURE
144 sq. in. = 1 sq. ft.	625 sq. li. = 1 sq. rd. or perch.
9 sq. ft. = 1 sq. yd.	16 sq. rd. = 1 sq. ch.
$30\frac{1}{4}$ sq. yd. } = 1 sq. rd.	10 sq. ch. = 1 A.
$272\frac{1}{4}$ sq. ft. } or perch.	640 A. = 1 sq. mi.
160 sq. rd. or perches = 1 A.	36 sq. mi. = 1 Tp.

CUBIC, OR SOLID, MEASURE

Cubic, or Solid, Measure is used in estimating all things that have the dimensions length, breadth, and thickness.

The principal units employed are the *cubic inch*; the *cubic foot*; the *cubic yard*. A cubic yard of earth is called a *load*.

TABLE

1728 cu. in. = 1 cu. ft.
27 cu. ft. = 1 cu. yd.
16 cu. ft. = 1 cd. ft.
8 cd. ft. } = 1 cd.
128 cu. ft. }

A *perch* of stone or of masonry is $16\frac{1}{2}$ ft. long, $1\frac{1}{2}$ ft. wide, and 1 ft. high. It contains $24\frac{3}{4}$ cu. ft.

A *cord* of wood is a pile 8 ft. long, 4 ft. wide, and 4 ft. high. The *cord foot*, which is practically obsolete, is $\frac{1}{8}$ of a cord, or 16 cu. ft.

MEASURES OF CAPACITY

Measures of **Capacity** are used in estimating quantity of fluids and many dry substances.

There are two sets of measures of capacity, one for liquids and one for dry substances.

The standard unit of **Liquid Measure** is the *gallon*, which contains 231 cu. in. The standard unit of **Dry Measure** is the *bushel*. It contains 2150.42 cu. in. Dry measure is used in measuring grain, fruit, lime, etc.

LIQUID MEASURE

4 gi. = 1 pt.

2 pt. = 1 qt.

4 qt. = 1 gal.

DRY MEASURE

2 pt. = 1 qt.

8 qt. = 1 pk.

4 pk. = 1 bu.

A pint of water weighs about a pound. A cubic foot of distilled water weighs about 1000 oz., or 62½ lb.

The *barrel* and *hogshead* do not express fixed quantities; they vary in different states. In estimating the capacity of cisterns, reservoirs, etc., the barrel is generally considered to contain 31½ gal., and the hogshead 63 gal.

MEASURES OF WEIGHT

The **Weight** of a body is the measure of the earth's attraction for it.

There are four sets of measures of weight: *Troy*; *Avoirdupois*; *Apothecaries'*; and *Apothecaries' Fluid*.

Troy Weight is used in weighing jewels and the precious metals, as gold and silver. The unit of weight is the *pound*, which contains 5760 gr.

Avoirdupois Weight is used in weighing nearly everything except gold, silver, and jewels. The unit of weight is the *pound*. It contains 7000 Troy grains.

The *carat* is a unit of 4 imaginary grains employed in rating diamonds and precious stones, as the ruby, topaz, emerald, etc. The

term is also used to express the fineness of gold. Thus, gold 18 carats fine consists of 18 parts pure gold, alloyed with 6 parts of some other metal, the whole mass being divided into 24 equal parts.

TROY WEIGHT	AVOIRDUPOIS WEIGHT
24 gr. = 1 pwt.	16 oz. = 1 lb.
20 pwt. = 1 oz.	100 lb. = 1 cwt.
12 oz. = 1 lb.	20 cwt. = 1 T.

At the United States customhouses, in invoices of imported goods, and in the wholesale trade of iron and coal, the ton of 2240 lb. is generally used.

The following table will show the number of avoirdupois pounds in a bushel of the principal farm products, as fixed by law :

COMMODITIES	WEIGHTS	COMMODITIES	WEIGHTS
Barley	48 lb.	Oats	32 lb.
Beans	60 lb.	Potatoes	60 lb.
Clover seed	60 lb.	Rye	56 lb.
Corn in the ear	70 lb.	Timothy seed	45 lb.
Corn shelled	56 lb.	Wheat	60 lb.

Some other denominations in common use :

56 lb. of butter = 1 firkin.	100 lb. dry fish = 1 quintal.
84 lb. of butter = 1 tub.	196 lb. flour = 1 barrel.
100 lb. of nails = 1 keg.	200 lb. pork or beef = 1 barrel.

APOTHECARIES' WEIGHT

Apothecaries' Weight is used by physicians and apothecaries in prescribing and preparing dry medicines. The unit is the *pound*, which contains 5760 gr., like the Troy pound. Medicines are bought and sold by avoirdupois weight.

Apothecaries' Fluid Measure is used by physicians and apothecaries in prescribing and preparing liquid medicines.

APOTHECARIES'

WEIGHT	APOTHECARIES' FLUID MEASURE
20 gr. = 1 ℥.	60 minims (℥) = 1 fluid dram (f ℥).
3 ℥ = 1 ℥.	60 fluid drams = 1 fluid ounce (f ℥).
8 ℥ = 1 ℥.	16 fluid ounces = 1 pint (O.) (Octavus).
12 ℥ = 1 lb.	8 pints = 1 gallon (Cong.) (Congius).

TIME

The unit of Time is the *day*.

TABLE

60 sec. = 1 min.
60 min. = 1 hr.
24 hr. = 1 da.
7 da. = 1 wk.
365 da. = 1 common year.
366 da. = 1 leap year.
100 yr. = 1 cen.

The year is divided into 12 periods, called calendar months. The following table will show the names of the calendar months and the number of days in each:

TABLE

NAMES OF MONTHS	DAYS IN EACH	NAMES OF MONTHS	DAYS IN EACH
1. January	31	7. July	31
2. February	28 or 29	8. August	31
3. March	31	9. September	30
4. April	30	10. October	31
5. May	31	11. November	30
6. June	30	12. December	31

Four weeks constitute what is called a *lunar month*; 13 lunar months and 1 day make a common year, 365 da.

The year is also divided into periods of 3 months, each constituting what is called a season. December, January, and February form the winter season; March, April, and May, spring; June, July, and August, summer; and September, October, and November, fall, or autumn.

By committing to memory the following stanza, the number of days in each month may be readily remembered:

“Thirty days hath September,
April, June, and November;
All the rest have thirty-one,
Except February alone,
Which has but twenty-eight in fine,
Till leap year gives it twenty-nine.”

NOTE.—In business transactions it is customary to consider 30 days as a month, and 12 months a year.

UNITED STATES MONEY

10 mills = 1 ¢.
10 ¢ = 1 d.
10 d. = \$1.
\$10 = 1 E.

ENGLISH MONEY

4 far. = 1 d.
12 d. = 1 s.
20 s. = 1 £.
21 s. = 1 guinea.

CIRCULAR MEASURE

TABLE

60 seconds (") = 1 minute (').
60 minutes = 1 degree (°).
360 degrees = 1 circumference (C.).

The term **Sign** is sometimes used to express 30°, from the fact that the ancients divided the zodiac into 12 parts

of 30° each, and represented each part by an arbitrary sign.

To distinguish these from minutes and seconds of *time*, the phrase *of arc* is employed. Thus, $30''$ is read, 30 seconds of arc.

COUNTING

12 units = 1 doz.

12 doz. = 1 gro.

12 gro. = 1 grt. gro.

20 units = 1 score.

PAPER

24 sheets = 1 quire (qr.).

20 quires (480 sheets) = 1 ream (rm.).

2 reams = 1 bundle (bun.).

5 bundles = 1 bale (B.).

ANSWERS

Page 5. — 1. 247. 2. 288. 3. 340. 4. 461. 5. 457. 6. 351.
 7. $53\frac{1}{2}$. 8. $80\frac{5}{8}$. 9. $74\frac{3}{4}$. 10. $86\frac{1}{2}$. 11. $114\frac{1}{2}$. 12. $108\frac{1}{2}$.
 13. $221.59\frac{7}{8}$. 14. $390.559\frac{1}{2}$. 15. $381.57\frac{1}{2}$. 16. $\$452.25\frac{1}{2}$. 17. $\$1020.69\frac{1}{2}$.

Page 6. — 1. $41\frac{7}{80}$ T. 2. $372\frac{13}{80}$ A. 3. 360. 5. $\frac{7}{5}$; $\frac{4}{5}$; $\frac{1}{10}$; $\frac{1}{250}$;
 $\frac{3}{50}$; $\frac{1}{5}$; $\frac{3}{8}$; $\frac{1}{16}$. 6. $42\frac{3}{4}$. 7. 176 cu. ft. 8. $52\frac{1}{2}$ cu. ft. 9. 2, 2, 2, 2, 67;
 2, 3, 3, 3, 47. 10. $13.79\frac{1}{2}$.

Page 7. — 32. 1400 lb. 33. $66\frac{2}{3}$ rd. 34. $1\frac{1}{2}$ doz. **Lesson 3.** — 1. $\frac{1}{2}$.
 2. $3\frac{5}{12}$. 3. $1\frac{3}{8}$. 4. $2\frac{5}{12}$. 5. $5\frac{7}{8}$. 6. $12\frac{3}{4}$. 7. $13\frac{1}{2}$. 8. $6\frac{1}{12}$. 9. $10\frac{7}{16}$.
 10. $20\frac{1}{2}$. 11. 5.61. 12. 14.25. 13. 21.435. 14. 45. 15. $14.61\frac{3}{4}$.
 17. 201. 18. 273. 19. 602. 20. 837. 21. 3596. 22. 1580.
 23. 5645. 24. 10,262.

Page 8. — 26. 66. 27. $49\frac{7}{12}$. 28. $78\frac{1}{2}$. 29. $477\frac{7}{8}$. 30. $198\frac{1}{2}$.
 31. $31\frac{1}{2}$. 32. $81\frac{3}{4}$. 33. $18\frac{3}{4}$. 34. $88\frac{1}{4}$. 35. $49\frac{1}{8}$. **Lesson 4.** —
 1. $39\frac{3}{4}$ sq. ft. 2. $\$2.83\frac{1}{8}$. 3. $325\frac{1}{2}$ sq. rd. 4. $\$23.78\frac{1}{2}$.

Page 9. — 5. $\$23.616$. 6. $\$35.20$. 7. $\$313\frac{3}{4}$. 8. 4 cu. ft. 9. 2 A.
 10. $\$9.56\frac{1}{2}$. 11. $\$3.75$; $\$1.88$. 12. 180. 13. 11 bu. 17. $\$4.55$.
 19. $2\frac{5}{8}$. 20. $2\frac{3}{4}$. 21. $3\frac{1}{5}$. 22. $2\frac{3}{8}$. 23. $3\frac{1}{16}$. 24. $3\frac{5}{11}$. 25. $2\frac{3}{8}$.
 26. $2\frac{3}{8}$.

Page 10. — 27. 32 wk. 28. 40. **Lesson 5.** — 9. $4\frac{1}{2}$. 10. 2.
 11. $1\frac{5}{16}$. 12. $11\frac{1}{16}$. 13. $1\frac{1}{16}$. 14. $3\frac{1}{2}$. 15. 6. 16. $3\frac{1}{2}$.
 17. 4.024; 50.0005; 3.3334; 500.

Page 11. — 18. $\$3000$. 19. 16. 20. $39\frac{1}{2}$ mi. 21. $\$15\frac{1}{2}$. 22. 5 T.
 23. 2, 3. 24. $\$5.77\frac{1}{2}$. **Lesson 6.** — 1. 243 sq. rd. 9 sq. yd. $8\frac{1}{2}$ sq. ft.
 2. 2304 cu. in. 3. £115 1s. 5d. 1.5 + far. 5. 1440 bd. ft.
 6. 243 da. 7. $\frac{1}{4}$. 8. 152 rd.

Page 12. — 10. 161 times. 11. $3\frac{1}{2}$ da. 12. .0125. 15. 365 A.
 16. 14 yd.; 12 yd. 19. $\$36$. 20. $\$1.44$. **Lesson 7.** — 1. $\$4.20$.
 2. 1584 cu. in. 3. $\$83.20$.

Page 13. — 4. $39\frac{1}{2}$ yd.; 6 breadths; 2 ft.; $\$33.57\frac{1}{2}$. 5. $298.75\frac{1}{2}$.
 6. $\$33\frac{1}{2}$. 7. $\$2697.24$. 8. $1\frac{10}{16}$; $1.063\frac{1}{2}$; 1.063125 . 10. 17.

Page 14.—3. $53\frac{1}{2}$ cu. ft. 4. .01203; 1200. 5. \$76.92. 7. \$30.22.
8. \$87.34 $\frac{1}{2}$. 9. $2\frac{2}{3}$ in.; $9\frac{1}{2}$ in. 10. \$605.64. 11. \$287.49 $\frac{1}{2}$. 12. 20 A.
13. 7¢. 14. 615.7538 sq. in. 15. \$9.51 $\frac{1}{2}$. 16. \$5.02 $\frac{1}{2}$.

Page 16.—4. 45¢; $\frac{1}{2}$ ¢; $1\frac{1}{2}$ ¢; $25\frac{1}{100}$ ¢; $\frac{1}{25}$ ¢. **Lesson 10.**—1. $\$1\frac{1}{2}$; \$2; \$15; \$21. 2. 3 yd.; 12 yd.; $14\frac{1}{2}$ yd. 3. $2\frac{1}{2}$ d.; $\frac{1}{2}$ d.; $\frac{1}{4}$ d.; $6\frac{1}{4}$ d.; $\frac{3}{4}$ d.; $\frac{1}{4}$ d. 4. \$13 $\frac{1}{2}$; \$1 $\frac{1}{2}$; \$ $\frac{1}{8}$; \$ $\frac{1}{16}$; \$ $\frac{1}{2}$. 5. 90.

Page 17.—**Lesson 11.**—1. 6180 far. 2. 11s. 10d. 2 far. 3. 3607d.
4. £2 15s. 8d. 5. £43 11s. 10d. 2 far. 6. £3 6s. 6d. 7. \$7.50
8. \$19.466; \$17.03; \$1.946+.

Page 18.—9. £4 2s.; £15 8s. 11. 13s. 4d. 13. $\frac{1}{10}$ ¢.

Page 19.—1. £ $\frac{5}{12}$; £ $\frac{1}{2}$. 2. £ $\frac{1}{2}$. 3. 2s. 10 $\frac{1}{2}$ d.; 11 $\frac{1}{2}$ d. 4. \$84.92.
5. \$.19 $\frac{1}{4}$. 6. \$48.25; \$119; \$231.60; \$67.55. 7. 647.66+ rubles;
2590.67+ francs; 2100.84+ marks; 2590.67+ lira. 8. 162,536 in.
9. 10 mi. 253 rd. 2 ft. 3 in. 10. 234 in.; 10 $\frac{1}{2}$ in.; 12 in.; 1.92 in.;
20 in.; 3 in. 11. 71 mi. 91 rd. 2 ft. 3 in. 12. 170 rd. 3 yd. 2 ft. 3 in.
13. 22 mi. 281 rd. 6 ft. $\frac{1}{4}$ in.

Page 20.—2. 40 rd. 3. 213 rd. 5 ft. 6 in. 4. 288 rd. 5. 240 rd.
6. 60 rd. 7. 14 ft. $5\frac{1}{2}$ in. 8. 704 yd.; $17\frac{1}{2}$ yd.; $\frac{7}{10}$ yd. 9. 16 rd.;
1066 $\frac{1}{2}$ rd.; $\frac{2}{3}$ rd.; $1\frac{1}{2}$ rd. 11. $\frac{2}{3}$ rd. 12. $\frac{2}{3}$ rd. 13. 137 rd. 2 ft. $4\frac{1}{2}$ in.
14. $\frac{4}{15}$ mi. 16. .145 mi. 17. .225 rd.

Page 21.—18. .435 mi. 19. 14 ft. 8 in. 20. 14 ft. $5\frac{1}{2}$ in.
Lesson 14.—2. $\frac{1}{2}$ in. 3. $\frac{2}{3}$ ft. 4. $\frac{1}{2}$ ft. 6. $\frac{1}{100}$ mi. 7. $\frac{1}{2}$ rd.
8. $\frac{1}{18}$ yd. 10. 144 rd. 5 yd. 1 ft. $\frac{2}{3}$ in. 11. 249 rd. 2 yd. $\frac{1}{2}$ in.
12. 200 rd. 1 yd. 2 ft. 3 in.

Page 22.—2. 3 mi. 47 rd. 13 ft. 3. 248 rd. 1 ft. 10 in. 4. 8 mi. 127 rd.
1 ft. $2\frac{1}{2}$ in. 5. \$320. 6. \$4.562. 7. 168. 8. 402 rd. 4 yd. 1 ft.
9. 32 hr. 10. 200d.

Page 23.—7. 19,624 li. 8. 51282.02 in. 9. 8 ch. 10. \$161,750.
11. 170 $\frac{1}{2}$ rd.; 2811 $\frac{1}{2}$ ft. 12. $\frac{2}{3}$ mi. 13. 2 min. 14. 4 ch. 80 li.
15. 37 li. 3.96 in. 16. $\frac{3}{8}$ mi.

Page 24.—12. 23,931 sq. in. 13. 389,560 $\frac{1}{2}$ sq. ft. 14. 100 sq. yd.
15. 1 A. 148 sq. rd. 14 sq. yd. 9 sq. in. 16. 8 sq. yd. 3 sq. ft. 3 sq. in.
17. 576 sq. in.; 5.76 sq. in.; 624 sq. in. 18. $\frac{1}{2}$ sq. ft.; 10 sq. ft.
19. 116 A. 58 sq. rd. 5 sq. yd. 4 sq. ft. 72 sq. in.

Page 25.—1. 93.775 sq. yd.; $\frac{1}{2}$ sq. yd.; $\frac{1}{10}$ sq. yd.; 12,100 sq. yd.;
4 $\frac{1}{2}$ sq. yd. 2. 300 sq. rd. 3. $\frac{1}{2}$ A.; $\frac{1}{10}$ A. 4. $\frac{1}{10}$ A. 5. $1\frac{1}{10}$ A.
6. \$80. 7. 20 rd. 8. \$723.10. 9. 4 A. 140 sq. rd. 25 sq. yd. 2 sq. ft.
10. 93 sq. rd. 10 sq. yd. 108 sq. in. 11. 36 sq. rd. 12. 51.2 A.
13. 410.36 rd. 14. 3 rd. 5 ft. 6 in.

Page 26. — 21. 7 breadths. 22. 20 rd.

Page 27. — 10. 862,272 cu. in. 11. 18 cu. yd. 4 cu. ft. 259 cu. in.
12. 17 cu. yd. 17 cu. ft. 187 cu. in. 13. 69.12 cu. in. ; 1162 cu. in. ;
57,600 cu. in. 14. $4\frac{1}{4}$ cu. ft. ; $\frac{1}{4}$ cu. ft. ; 320 cu. ft. ; $16\frac{1}{4}$ cu. ft. ; 12 cu. ft.
15. $3\frac{3}{8}$ cu. yd. ; 2.29 + cu. yd. ; $\frac{3}{4}$ cu. yd. 16. 60 cu. in.

Page 28. — 7. 900 gal. ; 16 cu. ft. 8. 96 bu. ; 150 cu. ft. 9. 1250 lb.
10. 67.2 cu. in. 11. $57\frac{3}{4}$ cu. in. 12. $23\frac{1}{11}$ liquid qt. 13. 12 gi. ; 1.28 gi. ;
22 gi. ; 1 gi. 14. $\frac{2}{3}$ pt. ; $\frac{1}{2}$ pt. ; 4 pt. ; $\frac{2}{3}$ pt. ; 1 pt. 15. $1\frac{1}{4}$ qt. ; 18 qt. ;
 $2\frac{1}{2}$ qt. 16. 4 bu. 4 qt. $1\frac{1}{2}$ pt. 17. 252. 18. 32¢. Lesson 21. — 1. 365 da.
2. \$212.19. 3. 82¢.

Page 29. — 4. 25.6 qt. ; 8 qt. ; 113.6 qt. 5. $2\frac{1}{2}$ pk. ; $2\frac{3}{4}$ pk.
6. $1\frac{2}{3}$ bu. ; $\frac{1}{3}$ bu. ; $\frac{1}{4}$ bu. ; $\frac{1}{8}$ bu. 7. $\frac{1}{2}$ bu. Lesson 22. — 1. 23.
2. 202. 3. 857 lb. $2\frac{3}{4}$ oz. 4. 7.2 oz.

Page 30. — 5. 6 lb. 11 oz. 2 pwt. 12 gr. 6. \$7680. 7. 10 oz. 15 pwt.
8. 71 lb. 7 oz. 7 pwt. 12 gr. ; 3 lb. 6 oz. 19 pwt. 9 gr. copper ; 32 lb. 2 oz.
14 pwt. 9 gr. silver. 9. 10,400 oz. 10. 2520 gr. 11. 5040 gr. ; 6125 gr.
12. $41\frac{1}{4}$ lb. 13. 8 lb. 3 oz. 7 pwt. 4.8 gr. 14. \$240.62 $\frac{1}{2}$. 15. A pound of
iron is 1240 gr. heavier. 16. An ounce of silver is $42\frac{1}{2}$ gr. heavier.
17. \$125 $\frac{1}{2}$. 18. $2\frac{1}{4}$ oz. 19. 200 bbl. 20. \$36.18.

Page 31. — 4. $\frac{1}{2}$ hr. ; $1\frac{1}{2}$ hr. ; $1\frac{1}{2}$ hr. ; $1\frac{1}{2}$ hr. 5. 36,740 min.
6. 1615 da. 7 hr. 7. 94 da. 21 hr. 36 min. 8. 136 da. 21 hr. 9. $\frac{2}{3}$ da. ;
 $38\frac{1}{2}$ da. 10. Sept. 22.

Page 32. — 11. .125 yr. 12. 280 da. 10 hr. 24 min. 13. 2 yr. 204 da.
3 hr. 28 min. 14. 5 wk. 3 da. 19 hr. 45 min. 58 sec.

Page 34. — 8. 158°. 9. 100°. 10. 125°.

Page 35. — 1. 294,328''. 2. 23° 31' 12''. 3. 165° 4' 42''. 4. 15° 35'
22''. 5. 72° 24' 16.3''. 6. 84° 43' 48''. 7. 8° 12' 54''. 8. $\frac{3}{8}$ of a
degree. 9. 18' 45''.

Page 38. — 10. $1^{\circ} 21' 3''$. 11. $7^{\circ} 5'$. 12. 30° 10'. 13. 63° 36' 43''.
14. 5° 56' 30'' 15. 21° 59' 57''. 16. 98° 27'.

Page 41. — 32. 7° 30'. 33. 11° 15'. 34. 33° 45'. 35. 56° 15'.
36. 3' 45''. 37. 10 A.M. ; 10.40 A.M. 38. 8 A.M. 39. 5.50 A.M.
40. 4 hr. 41. 11 A.M.

Page 42. — 8. \$315 ; \$28.28. 9. $9\frac{1}{4}$.

Page 43. — 1. $\frac{11}{20}$. 4. $31\frac{1}{2}$ ¢. 6. \$8.40. 8. \$109 $\frac{1}{2}$. 9. $\frac{3}{15}$.
10. $\frac{1}{2}$ mi. ; $\frac{11}{15}$ mi. ; $2\frac{2}{3}$ mi.

Page 44. — 11. $\frac{6}{25}$ T. ; $\frac{17}{10}$ T. ; $\frac{1}{2}$ T. 12. \$55. 13. $17\frac{1}{2}$ mi. 15. \$49 $\frac{1}{2}$.
17. 150 lb. 19. \$79.828.

Page 45. — 7. \$6 $\frac{1}{2}$. 8. 13 $\frac{1}{2}$ yd.; 10 yd. 9. \$2.70. 10. \$20 $\frac{1}{2}$.
14. 6.58 A.M.; 7.02 P.M. 15. 16 $\frac{1}{4}$ lb. 16. 30 yd.

Page 48. — 2. 750 sq. rd. 3. 700 sq. yd. 4. 40 sq. ft. 5. 3000 sq. rd.
6. 2100 sq. ft.

Page 50. — 2. 11 $\frac{1}{2}$ sq. yd. 3. 12 sq. rd.

Page 51. — 8. 288 sq. ft.; 45°; 64 ft.; 28 ft. **Lesson 38.** —
1. 147 $\frac{1}{2}$ sq. ft. 2. 75 $\frac{1}{2}$ sq. ft.

Page 52. — 3. 89 $\frac{1}{2}$ sq. rd. 4. 119 sq. rd.

Page 53. — 1. 98 $\frac{1}{2}$ sq. rd. 2. 40 rd. wide; 2 sq. in. 3. 8 in.
4. 1 $\frac{1}{2}$ sq. ft. 5. 13 $\frac{1}{2}$ sq. ft. 6. 80 sq. ft. 7. 640 sq. rd. 9. 800 sq. ft.; \$8.

Page 54. — 5. 6.2832 in. 6. 12.5664 in. 7. 18.8496 in. 8. 15.708 in.
9. 1.909+ in. diam.; .954+ in. radius. 10. 2.864+ in. diam.;
1.432+ in. radius. 11. 3.819+ in. diam.; 1.909+ in. radius.

Page 55. — 14. 12.5664 sq. in. **Lesson 41.** — 1. 8 in. diam.; 25.1328 in.
cir. 2. 3 in. rad.; 18.8496 in. cir.; 28.2744 sq. in. area. 3. 4 in. rad.;
25.1328 in. cir.; 50.2656 sq. in. area. 4. 3.819+ ft. diam.; 1.909+ ft. rad.;
11.457+ sq. ft. area. 5. 9.549+ yd. diam.; 4.774+ yd. rad.;
71.617+ sq. yd. area. 6. 60 ft. diam.; 30 ft. rad.; 188.496 ft. cir.;
2827.44 sq. ft. area. 7. 48 ft. diam.; 24 ft. rad.; 150.7968 ft. cir.;
1809.5616 sq. ft. area. 8. 36 ft. diam.; 18 ft. rad.; 113.0976 ft. cir.;
1017.8784 sq. ft. area. 9. 24 ft. diam.; 12 ft. rad.; 75.3984 ft. cir.;
452.3904 sq. ft. area.

Page 56. — 14. 825 sq. rd. 15. \$212 $\frac{1}{2}$.

Page 59. — 4. 11 $\frac{7}{11}$ P. 5. 3 cd. 6. 6 ft. 7. 1728 cu. in. 8. 27.
9. The first, 180 cu. in. more. 10. 6480. 11. 14 cu. ft. 12. 9 in.
13. 24,615 cu. in. 14. 16. 15. 22 $\frac{2}{3}$ T.

Page 60. — 6. 400 cu. ft. 7. 848.23+ cu. ft. 8. 35.343 cu. ft.
9. 4712.4 cu. in. 10. 106.8144 cu. ft.

Page 61. — 11. 368.843+ cu. ft. 12. 116.631+ cu. ft. **Lesson 45.** —
1. 34.91 cu. ft. 2. 111.121+ cu. ft. 3. 720 cu. ft. 4. 1728 cu. ft.
5. 16 in. 6. 125.664 cu. ft. 7. 300 cu. ft. 8. 6 ft. 9. 67 sq. ft. surface;
33 cu. ft. volume. 10. 89093.812+ cu. ft. 11. 960 cu. ft. volume;
720 sq. ft. surface.

Page 62. — 9. 85¢. 10. 470 lb. 11. \$57.75.

Page 63. — 12. 11.50 A.M.; 7.10 A.M. 13. 221.36 $\frac{1}{2}$. 14. 6 ft.
Lesson 47. — 1. 52¢. 2. 67 $\frac{1}{2}$ ¢. 7. 1 $\frac{1}{2}$; $\frac{3}{4}$; 2 $\frac{1}{2}$. 8. 22 $\frac{1}{2}$ yr.
12. $\frac{2}{3}$ pk.; $\frac{1}{2}$ qt. 13. 101 da. 22 hr. 20 min.

Page 64. — 14. \$6372. 15. \$6 $\frac{1}{2}$. 17. \$147.42. 18. \$55.90.
Lesson 48. — 13. \$13 $\frac{1}{11}$.

Page 65. — 14. 4 sq. ft. 15. $1\frac{1}{2}$ cu. yd. 16. 3 $\frac{1}{2}$ °. 17. 35°. 18. 3 hr. 12 min. 19. \$56.32. 20. \$1.536. 21. \$10.
Lesson 49. — 8. 48 bu. 9. 44.

Page 66. — 10. 22. 11. \$396.56 $\frac{1}{2}$. 12. \$172.50. 13. \$1640.625.
 14. 104.72 A.; 374 A. 15. 565.84 sq. ft. **Lesson 50.** — 2. \$6.60.
 4. \$26 $\frac{2}{3}$.

Page 67. — 10. 5808. 11. \$18. 12. 52 rd.; \$175.50. 13. £258
 18s. 3.1 + d. 14. 90 rd. 8 ft. 10 $\frac{1}{2}$ in. 15. 1 yr. 16 da. 16. 179 da.
 17. 364 bu. 18. 112 rd. 5 yd. 1 ft. 4 in. **Lesson 51.** — 1. \$13.23.
 2. 32 rd. 3. 110 rd. 4. 6.2832 sq. ft. 5. \$3.08.

Page 68. — 6. \$85. 7. $\frac{1}{2}$; 11 rd. 8. 4000 bu.

Page 69. — 19. 24. 20. 288 sq. in. 21. \$56.32.

Page 70. — 1. \$176. 2. 11,880 in. 3. \$17.85. 4. \$683.905 +.
 5. $\frac{1}{2}$ yd. 6. 9¢. 7. \$20 $\frac{1}{2}$. 8. 4608. 16. \$5 $\frac{1}{2}$.

Page 72. — **Lesson 55.** — 2. 149.5 bbl. 3. \$1621.80. 4. 54 mi.
 5. 225 cows. 6. 149.4 gal. 7. \$25.306 +. 8. 108 pens. 9. 61 $\frac{1}{2}$.
 10. 2.24 T. 11. 4.8 rd. 12. \$1.50. 13. \$.0093. 14. 331 $\frac{1}{2}$ in.
 15. 3750 hr. 16. 2000 yr. 17. \$416.

Page 73. — 18. \$44.88 $\frac{1}{2}$. 19. 255 bu. 20. \$540. 21. \$2307, land;
 \$4614, coal mine; \$8459, building lots. 22. 7 bu. 4 qt. 23. 2 lb. 10 oz.
 13 pwt. 8 gr. 24. \$38.875. 25. 33¢. 26. \$3666, each son's share;
 \$987, each daughter's share.

Page 74. — 16. 1400. 17. 1200. 18. 2000. 19. 900.

Page 75. — 20. 2000. 21. 6000. 22. \$5000. 23. 74 $\frac{2}{7}$ cu. yd.
 24. 5 A. **Lesson 57.** — 1. 106 $\frac{1}{2}$ bu. 2. 291.406 +. 3. 231 $\frac{1}{4}$. 4. 103 $\frac{1}{2}$.
 5. 712 $\frac{3}{4}$. 6. \$7280. 7. 43,200 T.; 60,480 T. 8. \$5. 9. \$2250.
 10. \$312.50.

Page 76. — **Lesson 58.** — 2. 490. 3. 765. 4. 400. 5. $\frac{2}{3}$.

Page 77. — 7. 5625. 8. 6 $\frac{1}{2}$ mi. 9. 6341 $\frac{7}{8}$. 10. 1 bu. 11. 93 mi.
 12. 960 ft. 13. 1600 A.

Page 78. — 10. 33 $\frac{1}{2}$ %; 15%. 11. 12 $\frac{1}{2}$ %; 40%. 12. 83 $\frac{1}{3}$ %; 12 $\frac{1}{2}$ %.
 13. \$100; 11 $\frac{1}{3}$ %. 14. 10% corn; 20% wheat; 30% rye.

Page 80. — 14. \$1.10; \$6.60. 15. 9 $\frac{1}{11}$ %. 16. \$2370. 17. 62 $\frac{1}{2}$ ¢.
 18. \$16.80. 19. \$8750. **Lesson 61.** — 4. 82 $\frac{2}{3}$ %. 8. 5 $\frac{1}{3}$ %. 9. 60¢.
 10. 25%.

Page 81. — 11. \$3000. 12. 40 A.; 20 A.; 10 A.; $7\frac{1}{2}$ A. 15. 20%.
 16. \$468.75. 17. $33\frac{1}{3}\%$; 25%; $12\frac{1}{2}\%$. 18. 75%. 19. $87\frac{1}{2}\%$. 20. 25%.
 21. $71\frac{2}{3}\%$. 22. \$1900. **Lesson 62.** — 1. $36\frac{1}{3}\%$. 2. \$140. 3. 400.

Page 82. — 4. 28.1. 5. 2840. 6. $60\frac{1}{3}\%$. 7. \$360. 8. 300.
 9. 20%. 10. $1\frac{1}{8}$ mi. 11. 6 cwt. 12. 10%. 13. 10%. 14. \$11 $\frac{1}{2}$.

Page 83. — 4. $44\frac{2}{3}\%$; $55\frac{1}{3}\%$. 5. $33\frac{1}{3}\%$; 20%; $14\frac{2}{3}\%$. 6. $14\frac{2}{3}\%$;
 $42\frac{2}{3}\%$; $71\frac{2}{3}\%$; 100%. 7. 15%. 8. 8 yd.; 12¢; \$9.45. 10. 35%.
 11. $28\frac{2}{3}\%$. 14. 25%. 15. \$2.13.

Page 84. — 11. \$132.

Page 85. — 13. \$131.25. 14. \$238. 15. \$92.355. 16. \$64.68.
 17. \$112.677. **Lesson 65.** — 2. \$681.983. 3. \$1227.05. 4. \$1367.862.

Page 86. — 5. \$1236.093. 7. \$27. 8. \$4.87 $\frac{1}{2}$. 9. \$50.22.
 10. \$6.93. 11. \$37.18. 12. \$91. 13. \$26.73. 14. \$125.12.
 15. \$9.21 $\frac{3}{4}$. 16. \$145.82. 17. \$55.48. 18. \$66.612. 19. \$64.343.
 20. \$72.979.

Page 87. — 11. \$345.10. 12. \$612.50.

Page 88. — 5. \$367.15.

Page 89. — 6. \$384.37 $\frac{1}{2}$. 7. \$647.20. 8. \$746.40. 9. \$877.80.
 10. \$733.468. 11. \$349.35. 12. \$607.50.

Page 90. — 2. $\frac{3}{4}$. 4. 24. 5. 495 bu. 7. \$14.77. 8. $1\frac{1}{10}$ ¢.

Page 91. — 9. 11 bbl. 10. $33\frac{1}{3}\%$. 11. \$3701 $\frac{1}{2}$. 12. \$25.90.
 13. \$2261. 14. \$35.70. 15. $8256\frac{1}{3}\%$. 16. 120,800; \$1245. 17. $29\frac{1}{2}\%$.
Lesson 69. — 1. \$1603.86 $\frac{1}{3}$. 2. \$5.40. 3. $9\frac{1}{2}\%$. 4. \$25. 5. 2100.
 6. 112.

Page 92. — 10. \$10.50. 12. \$39. 13. 54 yd. 18. 12.5664 sq. in.
 19. 50.2656 sq. in. **Lesson 70.** — 1. $18\frac{3}{4}$ ¢.

Page 93. — 2. $63\frac{7}{11}\%$. 3. $13\frac{1}{2}\%$. 4. \$50. 7. 184. 10. 800 men.
 11. 3408. 13. \$140, horse; \$186, carriage. 14. \$3.20. 15. 1%.

Page 94. — 16. 7 T. 17. \$26.847. **Lesson 71.** — 1. $102\frac{3}{8}$ A. = A's;
 68 $\frac{3}{8}$ A. = B's. 6. $355\frac{3}{8}\%$. 7. 1. 8. \$194.40 gain.

Page 95. — 11. \$66; \$16.50. 12. 50¢. 13. \$2.25. 14. $31\frac{1}{4}$ ¢.
 15. 80¢. **Lesson 72.** — 1. $60\frac{1}{2}$ A. 3. 68%. 4. \$34.

Page 96. — 10. \$2052. 11. \$90. 12. 12. 13. \$4. 15. $4\frac{1}{2}$ mi.
 19. \$2.94. 20. $19\frac{2}{3}$ yd.

Page 98. — 14. 320 A. 15. 320 A. 16. 10 A.

Page 99. — 2. 67. 3. 114. 4. \$31.92. 5. \$159.54.

Page 100. — 1. \$13.15. 2. 36.

Page 101. — 4. \$31.92. 5. \$4.05. 6. \$36. **Lesson 76.** — 1. 9. 2. \$17.01. 3. \$33.90. 4. \$3.

Page 102. — 5. 72 yd. 6. $29\frac{1}{2}$ yd. 10. 30 yd.; 5 strips; 12 in. turned under. **Lesson 77.** — 1. 15 cd. 2. 80 cd.

Page 103. — 3. $5\frac{1}{2}$ ft. 4. \$693. 11. 20 bd. ft. 12. 35 bd. ft.

Page 104. — 13. 900 bd. ft. **Lesson 78.** — 3. $16\frac{3}{4}$ bd. ft. 4. 26 bd. ft.

Page 105. — 6. 24 bd. ft. 7. 1100 bd. ft. 8. 588-bd. ft. 9. $426\frac{3}{4}$ bd. ft. 10. 512 bd. ft. 11. 432 bd. ft. 12. 800 bd. ft. **Lesson 79.** — 1. $6\frac{1}{4}$ M. 2. 38.

Page 106. — 3. 77 bunches; \$96.25. 4. \$255. 5. \$17.36. **Lesson 80.** — 1. $25\frac{5}{11}$ P. 2. \$56.32. 3. \$144. 4. $82\frac{1}{4}$ P.

Page 107. — 5. 2835. 6. 11,340. 7. 50,652. 8. \$972.22. 9. \$9.42. 10. \$6.28. 11. $48\frac{1}{3}$ P. 12. 27,300. 13. $17\frac{5}{11}$ P.

Page 108. — 2. 1132.2 bu. 3. 52.8 bu. 5. $723.21 + \text{bu.}$ 6. $818.63 + \text{bu.}$; 816 bu. **Lesson 82.** — 1. 311.11 cu. ft. 2. 80.267 cu. ft.; 80.625 cu. ft.

Page 109. — 3. $2\frac{1}{2}$ cu. ft. 6. 362.24 bu.; 360 bu. 7. 51.88 bu.; 51.66 + bu. 9. $198.76 + \text{cu. ft.}$; 200 cu. ft. 10. 477.03 cu. ft.; 480 cu. ft.

Page 110. — 2. 2154.39 gal.; 2155.68 + gal. 3. 440.65 gal. 4. 59.84 hhd. 5. 540.11 gal. 7. $193.7 + \text{cu. ft.}$ 8. 303 cu. ft.

Page 111. — 9. 228.02 bbl. 10. 119.39 bbl. 11. 80.28 bbl. 12. 1077.84 gal. 13. 800 cu. ft. 14. 4 gal.

Page 112. — 1. \$181.60. 2. \$21.06. 3. \$341. 4. 510. 7. \$15.30. 8. \$18.21 $\frac{1}{2}$. 9. \$4250. 11. 40 yd.; \$54.

Page 113. — 12. \$13.20. **Lesson 85.** — 2. 10 gross. 4. \$376.80. 5. 48.6 A. 6. 140.625 mi. 7. $22\frac{1}{2}$ bu. 9. 288. 10. $3\frac{1}{2}$.

Page 114. — 11. 180. 12. \$17,920. 14. \$162.40. 15. \$795.925. **Lesson 86.** — 2. 66.891 + sq. in., 4. 12¢. 5. \$23.62 $\frac{1}{2}$. 8. \$2057 $\frac{1}{2}$.

Page 115. — 11. $121\frac{1}{3}\%$. 12. \$16. 13. 157.5. **Lesson 87.** — 1. $33\frac{1}{2}$. 3. $1001\frac{1}{3}$. 5. 31.416 A. 6. 20%. 7. \$7.41 $\frac{1}{2}$.

Page 116. — 9. 47 rd. 14. $2\frac{3}{8}\%$. 18. 12%. 21. $48\frac{1}{8}\%$. 22. \$1 $\frac{1}{2}$. 23. \$3367.17.

Page 118. — 3. 11. 4. \$9.24. 5. 8. 6. \$18. 7. \$1.24. 8. \$5.84. 9. \$11. 10. 16 yd. 11. \$8.44. 12. 6 strips; \$32.40.

Page 119. — 1. \$30.94. 3. $96\frac{1}{4}$; $\frac{7}{13}$; $\frac{7}{13}$. 4. $4\frac{1}{2}$ yr. 5. $78\frac{1}{3}\%$. 6. 800. 8. $3.7306 + \text{in.}$

Page 120. — 13. \$3.50. **Lesson 90.** — 1. 400%. 3. \$754. 5. $22\frac{1}{2}\%$. 7. 90 A.

Page 121. — 10. 47.25 cu. in. 11. $161.37\frac{1}{2}$ mi. 12. 25%. 13. 27 da. 14. $36\frac{4}{11}\%$. 15. 9. 16. 9804. 18. 222 mi. 19. \$142.50. 20. $4\frac{1}{2}$ bu.

Page 81.—11. \$3000. 12. 40 A.; 20 A.; 10 A.; $7\frac{1}{2}$ A. 15. 20%.
16. \$468.75. 17. $33\frac{1}{3}\%$; 25%; $12\frac{1}{2}\%$. 18. 75%. 19. $87\frac{1}{2}\%$. 20. 25%.
21. $71\frac{1}{2}\%$. 22. \$1900. **Lesson 62.**—1. $36\frac{1}{3}\%$. 2. \$140. 3. 400.

Page 82.—4. 28.1. 5. 2840. 6. $60\frac{1}{2}\%$. 7. \$360. 8. 300.
9. 20%. 10. $1\frac{1}{4}\frac{1}{8}$ mi. 11. 6 cwt. 12. 10%. 13. 10%. 14. \$11 $\frac{1}{2}$.

Page 83.—4. $44\frac{1}{3}\%$; $55\frac{1}{3}\%$. 5. $33\frac{1}{3}\%$; 20%; $14\frac{2}{3}\%$. 6. $14\frac{2}{3}\%$;
 $42\frac{2}{3}\%$; $71\frac{1}{3}\%$; 100%. 7. 15%. 8. 8 yd.; 12¢; \$9.45. 10. 35%.
11. $28\frac{1}{2}\%$. 14. 25%. 15. \$2.13.

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10. \$6.93. 11. \$37.18. 12. \$91. 13. \$26.73. 14. \$125.12.
15. \$9.21 $\frac{1}{2}$. 16. \$145.82. 17. \$55.48. 18. \$66.612. 19. \$64.343.
20. \$72.979.

Page 87.—11. \$345.10. 12. \$612.50.

Page 88.—5. \$367.15.

Page 89.—6. \$384.37 $\frac{1}{2}$. 7. \$647.20. 8. \$746.40. 9. \$877.80.
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Page 91.—9. 11 bbl. 10. $33\frac{1}{3}\%$. 11. \$3701 $\frac{1}{2}$. 12. \$25.90.
13. \$2261. 14. \$35.70. 15. $8256\frac{1}{2}\frac{1}{2}$. 16. 120,800; \$1245. 17. $29\frac{1}{2}\frac{1}{3}\%$.
Lesson 69.—1. \$1603.86 $\frac{1}{2}$. 2. \$5.40. 3. $9\frac{1}{2}\%$. 4. \$25. 5. 2100.
6. 112.

Page 92.—10. \$10.50. 12. \$39. 13. 54 yd. 18. 12.5664 sq. in.
19. 50.2656 sq. in. **Lesson 70.**—1. $18\frac{1}{2}$ ¢.

Page 93.—2. $63\frac{7}{11}\%$. 3. $13\frac{1}{2}\%$. 4. \$50. 7. 184. 10. 800 men.
11. 3408. 13. \$140, horse; \$186, carriage. 14. \$3.20. 15. 1%.

Page 94.—16. 7 T. 17. \$26.847. **Lesson 71.**—1. $102\frac{1}{2}$ A. = A's;
 $68\frac{1}{2}$ A. = B's. 6. $355\frac{1}{2}\frac{1}{2}\%$. 7. 1. 8. \$194.40 gain.

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15. 80¢. **Lesson 72.**—1. $66\frac{1}{2}$ A. 3. 68%. 4. \$34.

Page 96.—10. \$2052. 11. \$90. 12. 12. 13. \$4. 15. $4\frac{1}{2}$ mi.
19. \$2.94. 20. $19\frac{1}{2}$ yd.

Page 98.—14. 320 A. 15. 320 A. 16. 10 A.

Page 99.—2. 67. 3. 114. 4. \$31.92. 5. \$159.54.

Page 100.—1. \$13.15. 2. 36.

Page 101. — 4. \$31.92. 5. \$4.05. 6. \$36. **Lesson 76.** — 1. 9. 2. \$17.01. 3. \$33.90. 4. \$3.

Page 102. — 5. 72 yd. 6. $29\frac{1}{2}$ yd. 10. 30 yd.; 5 strips; 12 in. turned under. **Lesson 77.** — 1. 15 cd. 2. 80 cd.

Page 103. — 3. $5\frac{1}{2}$ ft. 4. \$693. 11. 20 bd. ft. 12. 35 bd. ft.

Page 104. — 13. 900 bd. ft. **Lesson 78.** — 3. $16\frac{2}{3}$ bd. ft. 4. 26 bd. ft.

Page 105. — 6. 24 bd. ft. 7. 1100 bd. ft. 8. 588 bd. ft. 9. $426\frac{2}{3}$ bd. ft. 10. 512 bd. ft. 11. 432 bd. ft. 12. 800 bd. ft. **Lesson 79.** — 1. $6\frac{1}{4}$ M. 2. 36.

Page 106. — 3. 77 bunches; \$96.25. 4. \$255. 5. \$17.36. **Lesson 80.** — 1. $25\frac{5}{11}$ P. 2. \$56.32. 3. \$144. 4. $82\frac{1}{3}$ P.

Page 107. — 5. 2835. 6. 11,340. 7. 50,652. 8. \$972.22. 9. \$9.42. 10. \$6.28. 11. $48\frac{3}{8}$ P. 12. 27,300. 13. $17\frac{5}{11}$ P.

Page 108. — 2. 1132.2 bu. 3. 52.8 bu. 5. 723.21 + bu. 6. 818.63 + bu.; 816 bu. **Lesson 82.** — 1. 311.11 cu. ft. 2. 80.267 cu. ft.; 80.625 cu. ft.

Page 109. — 3. $2\frac{1}{2}$ cu. ft. 6. 362.24 bu.; 360 bu. 7. 51.88 bu.; 51.56 + bu. 9. 198.76 + cu. ft.; 200 cu. ft. 10. 477.03 cu. ft.; 480 cu. ft.

Page 110. — 2. 2154.39 gal.; 2155.68 + gal. 3. 440.65 gal. 4. 59.84 hhd. 5. 540.11 gal. 7. 193.7 + cu. ft. 8. 303 cu. ft.

Page 111. — 9. 228.02 bbl. 10. 119.39 bbl. 11. 80.28 bbl. 12. 1077.84 gal. 13. 800 cu. ft. 14. 4 gal.

Page 112. — 1. \$181.50. 2. \$21.06. 3. \$341. 4. 510. 7. \$15.30. 8. \$18.21 $\frac{1}{2}$. 9. \$4250. 11. 40 yd.; \$54.

Page 113. — 12. \$13.20. **Lesson 85.** — 2. 10 gross. 4. \$376.80. 5. 48.6 A. 6. 140.625 mi. 7. $22\frac{1}{2}$ bu. 9. 288. 10. $3\frac{1}{2}$.

Page 114. — 11. 180. 12. \$17,920. 14. \$162.40. 15. \$795.925. **Lesson 86.** — 2. 66.891 + sq. in., 4. 12¢. 5. \$23.62 $\frac{1}{2}$. 8. \$2057 $\frac{1}{2}$.

Page 115. — 11. $121\frac{3}{8}\%$. 12. \$16. 13. 157.5. **Lesson 87.** — 1. $33\frac{3}{4}$. 3. $1001\frac{7}{8}$. 5. 31.416 A. 6. 20%. 7. \$7.41 $\frac{3}{4}$.

Page 116. — 9. 47 rd. 14. $2\frac{3}{8}\%$. 18. 12%. 21. $48\frac{1}{3}\%$. 22. $11\frac{1}{2}$. 23. \$3367.17.

Page 118. — 3. 11. 4. \$9.24. 5. 8. 6. \$18. 7. \$1.24. 8. \$5.84. 9. 11. 10. 16 yd. 11. \$8.44. 12. 6 strips; \$32.40.

Page 119. — 1. \$30.94. 3. $96\frac{1}{2}$; $\frac{77}{178}$; $\frac{2}{3}$. 4. $4\frac{1}{2}$ yr. 5. $78\frac{1}{3}\%$. 6. 800. 8. 3.7306 + in.

Page 120. — 13. \$3.50. **Lesson 90.** — 1. 400%. 3. \$754. 5. $22\frac{1}{2}\%$. 7. 90 A.

Page 121. — 10. 47.25 cu. in. 11. $161.37\frac{1}{2}$ mi. 12. 25%. 13. 27 da. 14. $36\frac{4}{11}\%$. 15. 9. 16. 9804. 18. 222 mi. 19. \$142.50. 20. $4\frac{1}{2}$ bu.

Page 122. — 3. \$9.45. 4. \$156.25. 5. \$145.12½; \$5659.87½.

Page 123. — 6. \$132.48; \$2811.52. 7. \$1781.25. **Lesson 92.** — 2. \$4626. 3. \$8463.

Page 124. — 5. \$265.30. 6. \$8000. **Lesson 93.** — 1. 5½%. 2. 2½%. 3. 3¼%. 4. \$5756. 5. 2%. 6. 800 bbl.

Page 125. — 7. 5½%. 8. \$2370.20. 9. \$804.40. 10. 30%. 11. \$7200. 12. \$14,125.

Page 126. — 1. \$31.50. 2. \$1.20. 3. \$105. 4. \$104.16.

Page 127. — 6. \$13,230. **Lesson 95.** — 1. 69¢. 2. \$177.45. 3. \$10. 4. 45% dis. is \$45 better. 5. \$480. 6. \$142.75. 7. 40% and 10% is \$67 more. 8. \$34.46.

Page 128. — 9. \$757. 10. 6%. 11. \$395.85. 12. \$515.60. 13. \$320.93. 14. \$2443.87½. 15. \$36.

Page 130. — **Lesson 97.** — 1. \$81. 2. \$78.75. 3. \$115.72. 4. \$511.50. 5. \$146.33.

Page 131. — 7. 5 mills. 9. \$10,000. 10. \$2,280,000.

Page 133. — 2. \$61.25. 3. \$36. **Lesson 99.** — 1. \$31.50. 2. \$30.75. 3. \$33.75; \$2700. 5. \$52.50.

Page 134. — 7. ½%. 9. \$46,000. 10. \$5333½. 11. \$2180.12½. 12. \$27,600.

Page 137. — 8. $\frac{1}{17}$; $\frac{2}{18}$; 6; $\frac{2}{9}$; $\frac{1}{2}$. 14. $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{2}$; 10; $\frac{1}{2}$; $\frac{1}{2}$; $\frac{1}{2}$; $\frac{1}{2}$.

Page 138. — 5. \$122.50. 10. 96 bu.

Page 139. — 4. \$3200. 7. 346½ gal. 8. \$1200. 9. \$9.30.

Page 140. — 4. 240 rd.; 1320 yd.; 3960 ft. 5. 22½ bu. 7. \$67.50. 8. \$375. 9. \$11.50. 10. \$7.92. 11. \$27. 12. \$11.587.

Page 141. — 15. 589½ gal. 16. 48½ ft. 17. 15½ rd. 18. 18½%. 19. \$12.01½. **Lesson 105.** — 4. \$524½. 5. \$20. 6. \$75.60. 7. \$452.39. 8. \$118.78.

Page 142. — 9. ¾%. 10. \$31.28. 11. 20 yd. 12. \$11.84. 13. 7. **Lesson 106.** — 2. 36 qt. 3. 204.908 bu. 4. \$7.24.

Page 143. — 6. 2 hr. 40 min.; 20 min, past 11 A.M. 7. 1007½ ft. 9. \$2000. 11. 20 ¢. 12. 4%. 14. \$2896. **Lesson 107.** — 19½ bd. ft.

Page 144. — 2. \$30.80. 3. 56.8%. 4. 75½ bu. 5. 825.02 cu. in. 6. 108 sq. yd. 8. 125. 9. 3000 sq. in. 10. The second will hold 2520 cu. in. more. 11. 5 $\frac{2}{3}$ 13 2 $\frac{1}{2}$.

Page 145. — 13. 231 cu. ft. **Lesson 108.** — 1. 1190 bd. ft. 2. 1064 bd. ft.; 2592 bd. ft.

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